

HP StorageWorks Modular Smart Array 500 System User Guide

(formerly Smart Array Cluster Storage System)



March 2005 (Fifth Edition)
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About This Guide

This guide provides step-by-step instructions for installation, and reference information for operation, troubleshooting, and future upgrades.

Audience Assumptions

This guide is for the person who installs, administers, and troubleshoots storage systems. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

Important Safety Information

Before installing this product, read the *Important Safety Information* document included with the system.

Symbols on Equipment

The following symbols may be placed on equipment to indicate the presence of potentially hazardous conditions:



WARNING: This symbol, in conjunction with any of the following symbols, indicates the presence of a potential hazard. The potential for injury exists if warnings are not observed. Consult the documentation for specific details.



This symbol indicates the presence of hazardous energy circuits or electric shock hazards. Refer all servicing to qualified personnel.

WARNING: To reduce the risk of injury from electric shock hazards, do not open this enclosure. Refer all maintenance, upgrades, and servicing to qualified personnel.



This symbol indicates the presence of electric shock hazards. The area contains no user or field serviceable parts. Do not open for any reason.

WARNING: To reduce the risk of injury from electric shock hazards, do not open this enclosure.



This symbol on an RJ-45 receptacle indicates a network interface connection.

WARNING: To reduce the risk of electric shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



This symbol indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



These symbols, on power supplies or systems, indicate that the equipment is supplied by multiple sources of power.

WARNING: To reduce the risk of injury from electric shock, remove all power cords to completely disconnect power from the system.



Weight in kg
Weight in lb

This symbol indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manual material handling.

Rack Stability



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
 - The full weight of the rack rests on the leveling jacks.
 - The stabilizing feet are attached to the rack if it is a single-rack installation.
 - The racks are coupled together in multiple-rack installations.
 - Only one component is extended at a time. A rack may become unstable if more than one component is extended for any reason.
-

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.



CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents essential information to explain a concept or complete a task.

NOTE: Text set off in this manner presents additional information to emphasize or supplement important points of the main text.

Related Documents

For additional information on the topics covered in this guide, refer to the following documentation:

- *HP StorageWorks Modular Smart Array 500 System Hardware Configuration and Installation Poster*
- *HP StorageWorks Modular Smart Array 500 Controller Installation Instructions*
- *HP DC Power Supply Option Installation Instructions*
- *HP 4-Port Shared Storage Module Option Installation Instructions*
- *HP M-Series Rack Rail Option Installation Instructions*
- *HP Smart Array Multipath Software User Guide*
- *HP StorageWorks Modular Smart Array 500 System Maintenance and Service Guide*
- Documentation CD

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Technical Support

In North America, call the HP Technical Support Phone Center at 1-800-652-6672. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored. Outside North America, call the nearest HP Technical Support Phone Center. Telephone numbers for worldwide Technical Support Centers are listed on the HP website, www.hp.com.

Be sure to have the following information available before you call HP:

- Technical support registration number (if applicable)
- Product serial number

- Product model name and number
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

HP Website

The HP website has information on this product as well as the latest drivers and flash ROM images. You can access the HP website at www.hp.com.

Authorized Reseller

For the name of the nearest authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the HP website for locations and telephone numbers.

Reader's Comments

HP welcomes your comments on this guide. Please send your comments and suggestions by e-mail to ServerDocumentation@hp.com.

Component Identification

The HP StorageWorks Modular Smart Array 500 system is a rack-mountable 4U SCSI storage system with redundant HP StorageWorks MSA500 controllers and power supply/blower assemblies. Fault-tolerance support includes RAID 0, 1, 1+0, 5, and Advanced Data Guarding (ADG), all with battery-backed cache. The Ultra3 SCSI hard drive interface supports Universal Hot-Plug tape drives with AIT and DDS-4 technology and supports up to 14 (1-inch) universal hot-plug SCSI hard drives.

Front Panel Components

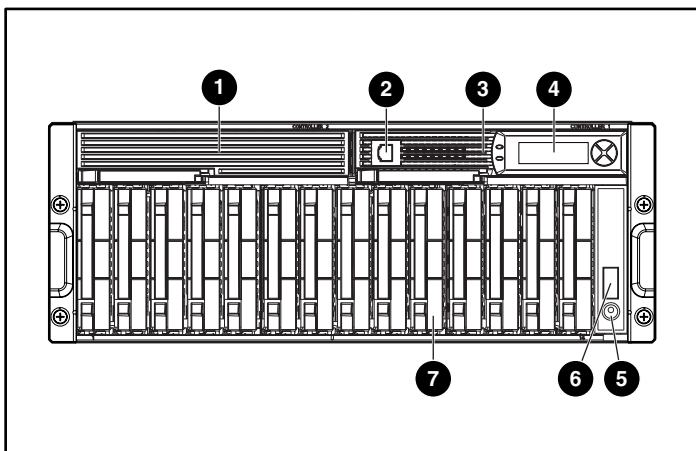


Table 1-1: Front Panel Components

Item	Description
1	Bezel blank (bay for optional redundant controller)
2	Service port (for HP service technicians only)
3	Hot-plug MSA500 controller
4	Controller display
5	Power On/Standby button
6	Enclosure LEDs (Refer to Table 1-2)
7	Hot-plug SCSI hard drive bays with blanks

Enclosure LEDs

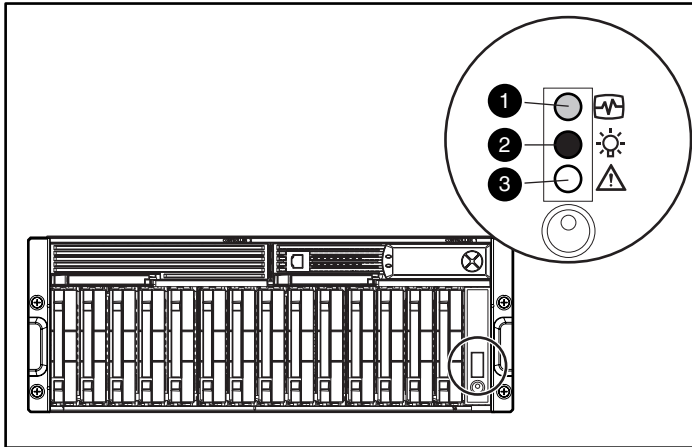


Table 1-2: Enclosure LEDs

Item	LED Description	Status
1	Environmental Monitoring Unit (EMU) heartbeat	Green flashing = Shared storage module is operating normally. Green/Off = Shared storage module is not operating normally.
2	System power	Green = System power is On. Off = System is in standby mode or power is removed from the system.
3	Fault	Amber = Fault is detected in a subsystem. Off = No faults are detected.

IMPORTANT: The Power On/Standby button does not remove all power from the system. The Standby mode removes power from most of the electronics and the drives, but portions of the power supply and some internal circuitry remain active. To remove power completely, disconnect all power cords from the equipment.

Rear Panel Components

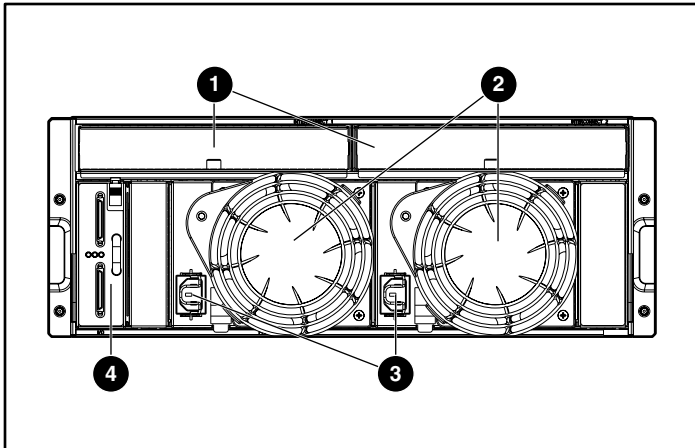
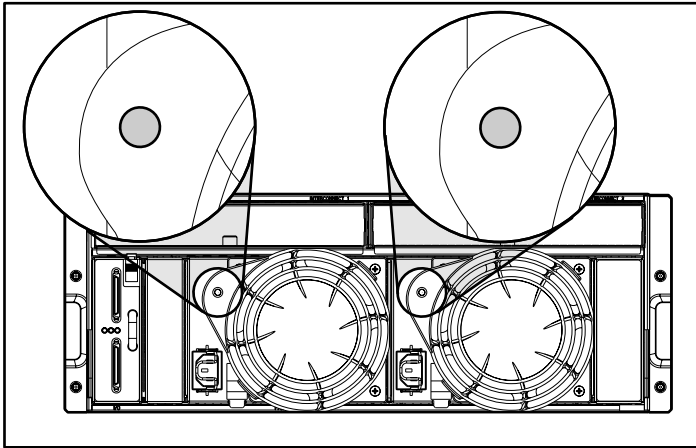


Table 1-3: Rear Panel Components

Item	Description
1	Interconnect blanks (required for proper airflow)
2	Power supply/blower assemblies
3	AC power connectors
4	2-Port Shared Storage Module

Power Supply/Blower Assembly LEDs



The power supply/blower assembly LEDs have the following functions:

- Green—The power supply is receiving power, and the blower is operating normally.
- Off—No power is present; the power supply or the blower has failed.

Shared Storage Module with Integrated Environmental Monitoring Unit

The MSA500 system supports two-node clustering and up to four-node direct attached storage (DAS) with Ultra3 SCSI I/O hardware. The system ships standard with the 2-Port Shared Storage Module. A 4-Port Shared Storage Module is available as an option.

Shared Storage Module Overview

Shared Storage Module functions include:

- Provides the interconnect function to server nodes
- Monitors the enclosure operation for:
 - Temperature
 - Power supplies
 - Blowers
 - Drive presence
- Detects and reports component changes in the enclosure (identifies hot-plug addition and removal)
- Controls drive and enclosure LEDs

2-Port Shared Storage Module Components

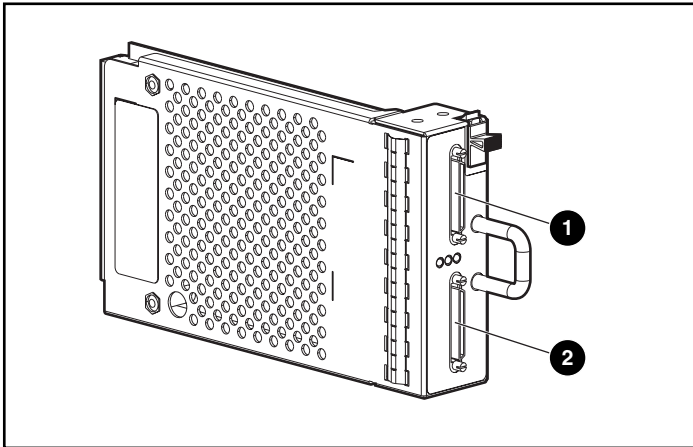


Table 1-4: 2-Port Shared Storage Module Components

Item	Description	Bus
1	SCSI port connector	A
2	SCSI port connector	B

2-Port Shared Storage Module LEDs

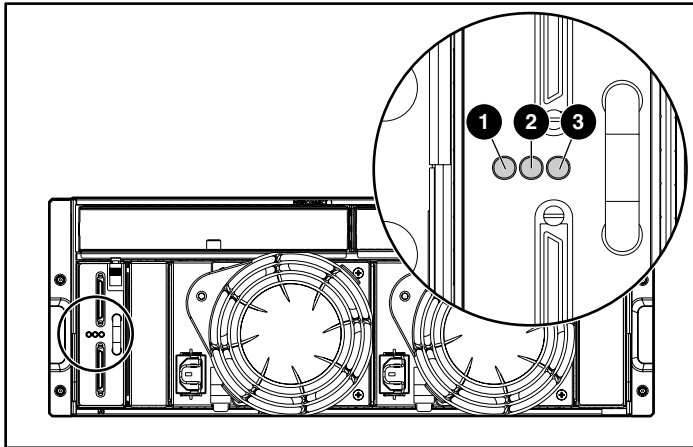


Table 1-5: 2-Port Shared Storage Module LEDs

Item	LED Description	Status
1	Power	Green = Power on Off = Power off
2	SCSI host port A	Flashing green = On/Activity
3	SCSI host port B	Off = Off

4-Port Shared Storage Module Components

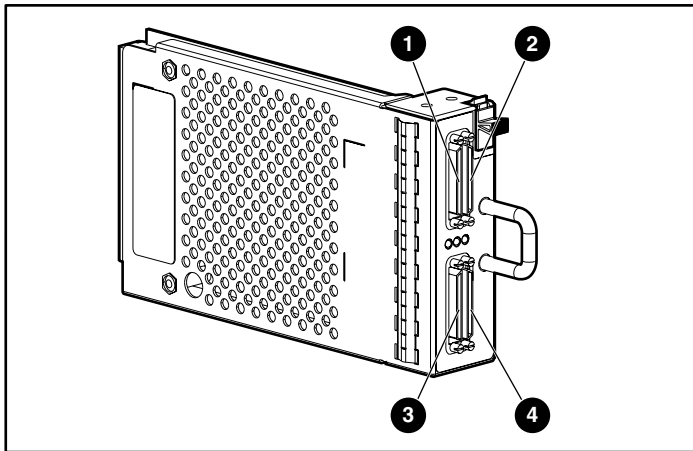


Table 1-6: 4-Port Shared Storage Module Components

Item	Description	Bus
1	SCSI port connector A1	A
2	SCSI port connector A2	
3	SCSI port connector B1	B
4	SCSI port connector B2	

4-Port Shared Storage Module LEDs

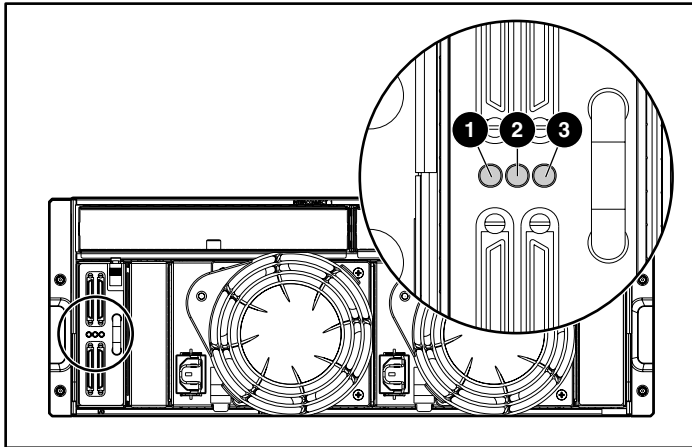


Table 1-7: 4-Port Shared Storage Module LEDs

Item	LED Description	Status
1	Power	Green = Power on Off = Power off
2	SCSI host port A connectors 1 and 2	Flashing green = On/Activity Off = Off
3	SCSI host port B connectors 1 and 2	

Controller Components

Controller Display

Each MSA500 controller has an LCD display for informational and error messages.

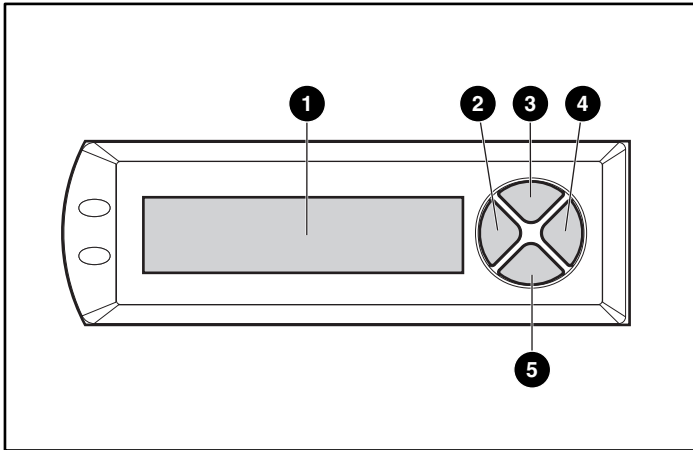


Table 1-8: Controller Display

Item	Description
1	Display
2	Left button
3	Up button
4	Right button
5	Down button

Controller LEDs

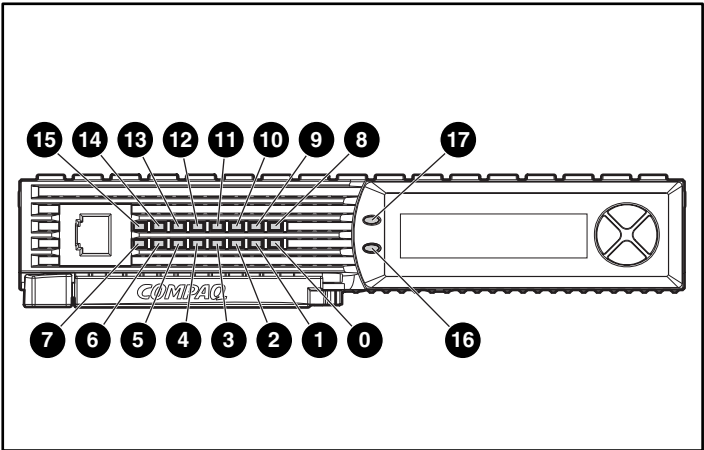


Table 1-9: Controller LEDs

Item	LED Descriptions	Status
0-2	Busy status	Green = Controller is idle. Off = Controller is operating at full capacity.
3-5	No function	—
6	Host port A notification	Green = Notify On Event command active Off = No Notify On Event command active
7	Host port B notification	Green = Notify On Event command active Off = No Notify On Event command active
8	Idle heartbeat	Controller is idle and functioning.
9	Active/Standby	Green = Controller is active. Off = Controller is in standby.
10	DMA activity	Green = DMA transfers are active. Off = No DMA transfers.

continued

Table 1-9: Controller LEDs *continued*

Item	LED Descriptions	Status
11	Logical I/O activity	Green = Currently processing logical requests from the host adapter. Off = No processing of logical requests
12	SCSI bus 0 activity	Green = Outstanding requests on the SCSI bus
13	SCSI bus 1 activity	Off = No outstanding requests
14	Cache activity	Green = Cache activity Off = No cache activity Flashing green = Cache transfer pending
15	Drive failure	Green = An array-configured drive has failed. Off = No drive failures
16	Active redundancy	Green = Controllers are operating with redundancy. Off = No redundancy
17	Fault	Amber = Error message received by controller display. Off = No error message received or no error message currently displayed.

Battery-Backed Cache Module Overview

The battery-backed cache module is a high-performance, 100-MHz SDRAM DIMM read/write cache that increases performance in database and fault-tolerant configurations.

Caching Functions

To enable faster data access from disk storage, the cache module performs two types of caching:

- Posted-write caching—the controller writes user data in the cache memory on the module rather than directly to the drives. Later, when the system is idle, the controller writes the data to the drive array.
- Read-ahead caching—the controller detects sequential array access, reads ahead into the next sequence of data, and stores the data in the read-ahead cache. Then, if the next read access is for the cached data, the controller immediately loads the data into system memory, avoiding the latency of a disk access.

Batteries

The cache module has two rechargeable and replaceable NiMH battery packs that protect cached data during equipment failure or power outage:

- Up to 3 days protection for 256-MB cache DIMMs
- Up to for 4 days protection for 128-MB cache DIMMs

Under normal operating conditions, the battery packs should operate for 3 years before replacement is necessary. The batteries recharge continuously when the system is powered on.

NOTE: Temperature, age, and cache size may affect battery life.

The batteries also preserve data when you remove the cache module from the controller. After you reinstall the cache module, and power is restored, the initialization process writes the preserved data to the array. This feature is important for data stored in the posted-write cache, but not yet written to an array.

SCSI IDs

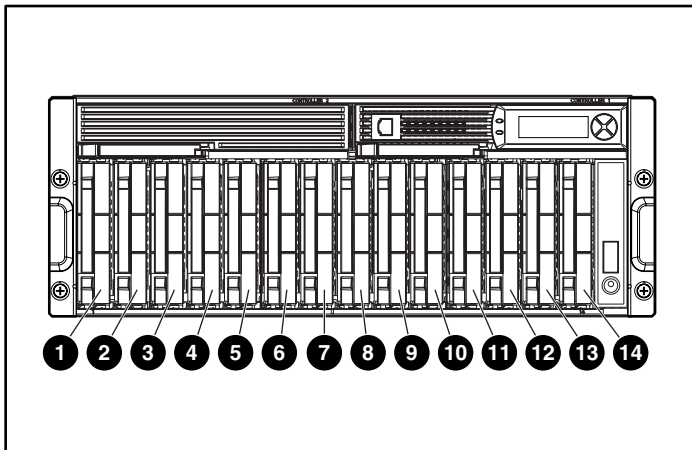


Table 1-10: SCSI IDs

Bay	SCSI ID	Bus Port
1	0	0
2	1	
3	2	
4	3	
5	4	
6	5	
7	8	

continued

Table 1-10: SCSI IDs *continued*

Bay	SCSI ID	Bus Port
8	0	1
9	1	
10	2	
11	3	
12	4	
13	5	8
14	8	

Hot-Plug SCSI Hard Drive LEDs

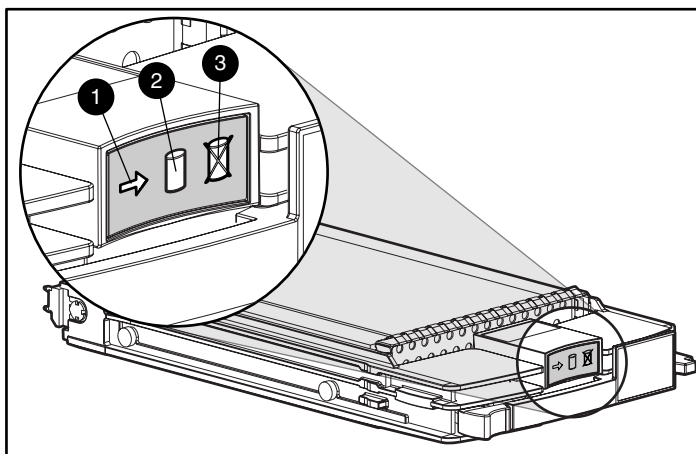


Table 1-11: Hot-Plug SCSI Hard Drive LEDs

Item	LED Description
1	Activity
2	Online
3	Fault

Hot-Plug SCSI Hard Drive LED Combinations

Table 1-12: Hot-Plug SCSI Hard Drive LED Combinations

Activity LED	Online LED	Fault LED	Status
On	Flashing	Off	<p>Do not remove the drive. Removing a drive during this process can cause data loss in non-fault-tolerant configurations.</p> <ul style="list-style-type: none"> The drive is a replacement drive and is being rebuilt or If all online LEDs in a drive array are flashing, an expansion is occurring.
Off	Off	On	<p>OK to replace the drive online.</p> <p>The drive has failed and has been placed offline.</p>
Off, on, or flashing	On	Off	<p>Do not remove the drive. Removing a drive during this process can cause data loss in non-fault-tolerant configurations.</p> <p>The drive is online and configured as part of an array.</p>
Off, on, or flashing	On or Off	Flashing	<p>A predictive failure alert has been received for this drive. Replace the drive as soon as possible.</p>

Installation and Operation

To install an MSA500 system:

1. Unpack the system. Refer to “Shipping Container Contents” in this chapter.
2. Install the system in a rack. Refer to “Installing the System into the Rack” in this chapter.
3. Install hardware options, if applicable. Refer to procedures in Chapter 3, “Hardware Options Installation.”
4. Connect SCSI cables and power cords. Refer to “System Cabling” in this chapter.
5. Power up the system. Refer to “System Power Up” in this chapter.
6. Configure arrays. Refer to Chapter 4, “Configuration and Utilities.”

Optimum Environment

When installing the MSA500 system in a rack, select a location that meets the environmental standards described in Appendix E, “Specifications.”

For adequate airflow, use appropriate high-airflow inserts in rack cabinet doors and observe industry standard practices for adequate spacing between racks or rows of racks.

Warnings



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- The stabilizing feet are attached to the rack if it is a single-rack installation.
- The racks are coupled together in multiple-rack installations.
- Only one component is extended at a time. A rack may become unstable if more than one component is extended for any reason.



WARNING: To reduce the risk of personal injury or equipment damage when unloading a rack:

- At least two people are needed to safely unload the rack from the pallet. An empty 42U rack can weigh as much as 115 kg (253 lb), can stand more than 2.1 m (7 ft) tall, and may become unstable when being moved on its casters.
- Never stand in front of the rack when it is rolling down the ramp from the pallet. Always handle the rack from both sides.

Shipping Contents

Unpack the system shipping carton and locate the materials and documentation necessary for installing the system. All the rack mounting hardware necessary for installing the system into the rack is included with the rack or the system.

Shipping Container Contents

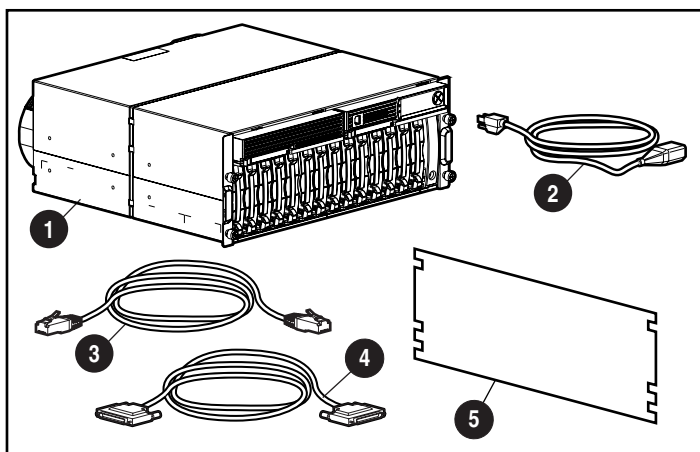


Table 2-1: Shipping Container Contents

Item	Description	Quantity
1	MSA500 system	1
2	Power cords	2
3	Ethernet crossover cable	1
4	SCSI VHDCI cables	2
5	4U rack template	1
6	Rack mounting hardware kit*	1
7	Documentation set*	1
*Not shown		

In addition to these supplied items, you may need:

- Application software diskettes
- Options to be installed

Rack Mounting Hardware Kit Contents

The rack mounting hardware kit provides the required components for quick deployment in Compaq branded, HP branded, and most square- and round-hole third-party racks. The adjustable feature of the rack rails enables installation in racks with depths of 69.90 to 73.81 cm (27.52 to 29.06 in).

If you are installing the MSA500 system in an M-Series rack, contact an authorized reseller to obtain an M-Series Rack Rail option kit.

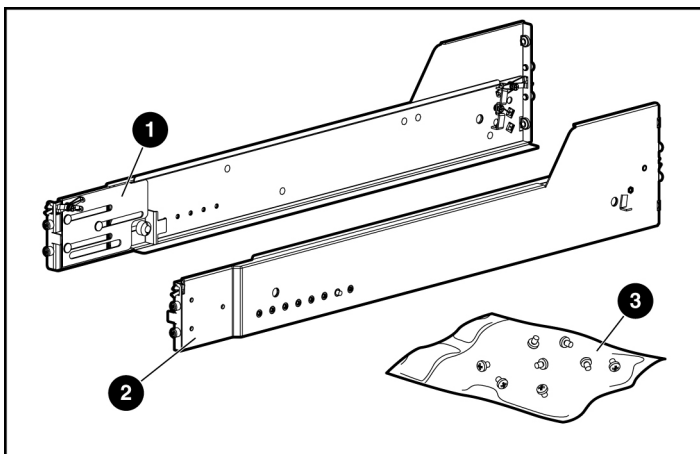


Table 2-2: Rack Mounting Hardware Kit Contents

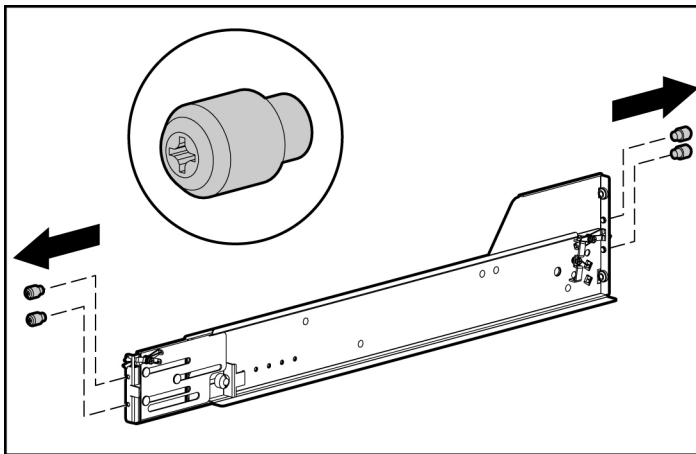
Item	Description	Quantity
1	Rack rail (left)	1
2	Rack rail (right)	1
3	Pins for round-hole rack conversion	8

In addition to these supplied items, you may need a No. 2 Phillips screwdriver.

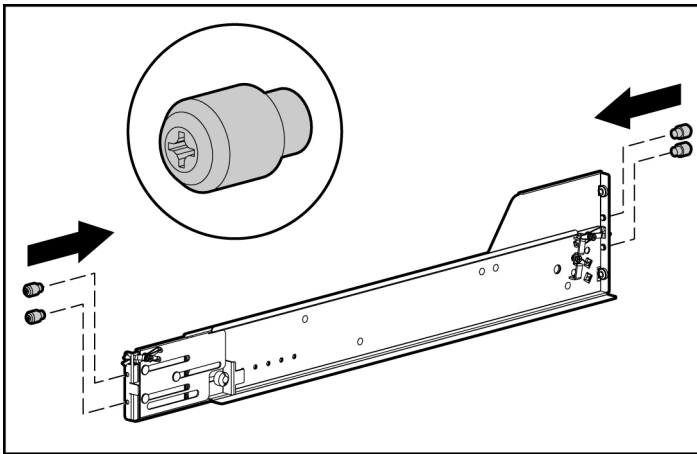
Converting the Rack Rails for Round-Hole Racks

The rack rails ship configured for square-hole racks. To convert the rack rails for use in a round-hole rack:

1. Locate the bag of miscellaneous hardware that ships with the rack rails.
2. Locate the eight round-hole pins.
3. Use a No. 2 Phillips screwdriver to remove the standard pins from the front and back ends of the rail.



4. Install four round-hole pins into the rail.



5. Repeat steps 3 and 4 for the second rail.

Installing the System into the Rack

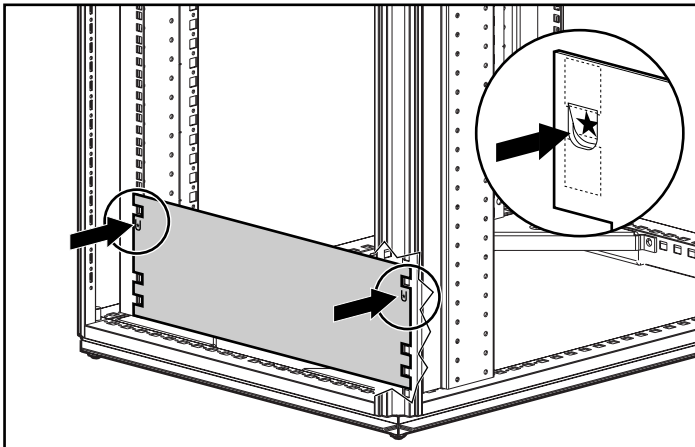
To install the system in the rack:

1. Use the instructions provided on the rack template to mark the rack for rail locations.



WARNING: The storage system weight, as assembled for shipping, exceeds 22.7 kg (50 lb). Install the storage system in the lowest available position in the rack.

22.7 kg
50 lb

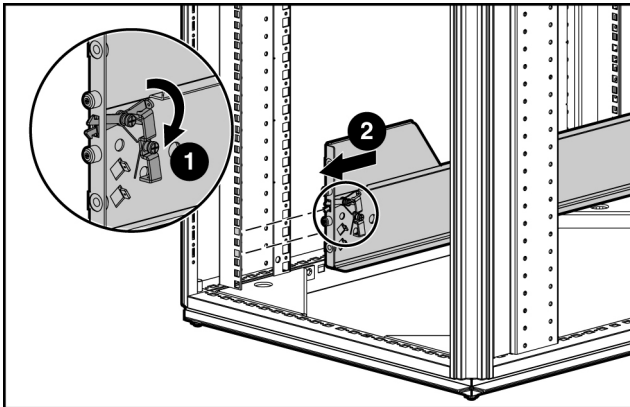


IMPORTANT: Unless you are converting the rails for use in round-hole racks, **do not** remove the pins from the ends of the rack rails. These load-bearing pins are designed to fit through the holes without being removed.

NOTE: Identify the left (L) and right (R) rack rails by markings stamped into the sheet metal.

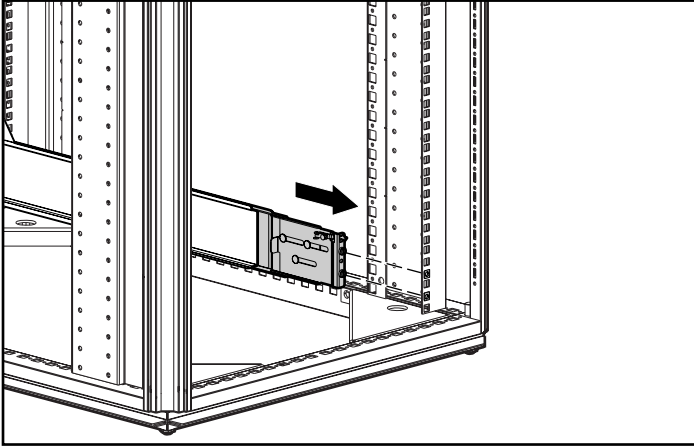
2. Insert the front end of the left rack rail into the inside front of the rack. Be sure that the pins extend through the holes marked during the rack template procedure.

IMPORTANT: Be sure that the scissor-type locking latch engages when the end of the rail seats into the rack uprights.



3. Slide the back end of the left rack rail into the inside rear of the rack. Be sure that the pins extend through the holes marked during the rack template procedure.

IMPORTANT: Be sure that the scissor-type locking latch engages when the end of the rail seats into the rack uprights.



4. Repeat steps 2 and 3 for the right rack rail.

5. Align the system with the rails and slide it into the rack.



22.7 kg
50 lb

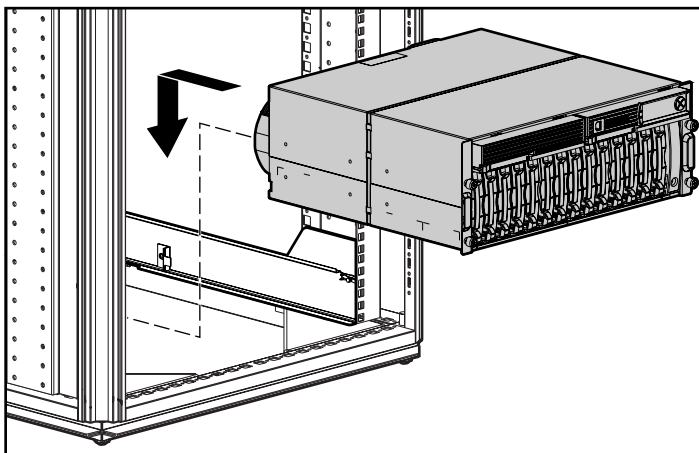
WARNING: The storage system weight, as assembled for shipping, exceeds 22.7 kg (50 lb). To reduce the risk of personal injury or damage to the equipment, at least two people are required to lift the storage system during removal or installation. Install the storage system in the lowest available position in the rack.



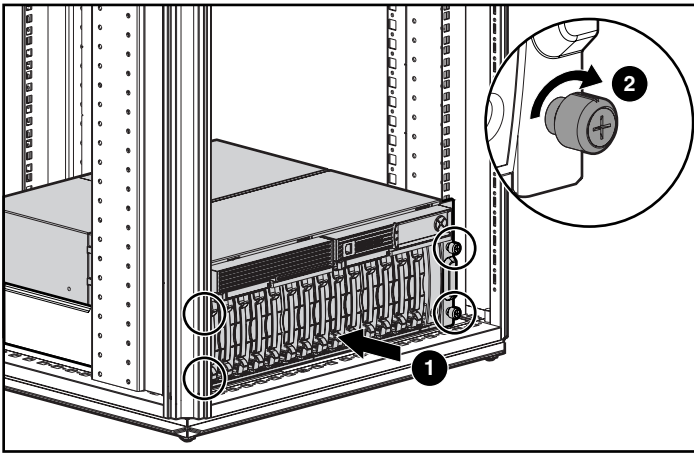
WARNING: Always use at least two people to lift a storage system into the rack. If the system is being loaded into the rack above chest level, a third person **MUST** assist with aligning the system with the rails while the other two people support the weight of the system.



CAUTION: To prevent storage system damage and ease insertion, support the weight of the storage system and keep it level when sliding the storage system into the rack.

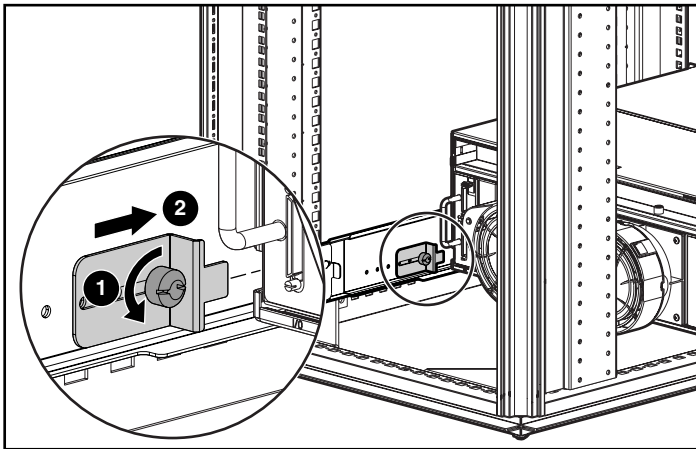


6. Secure the system to the rack.



IMPORTANT: Use of the shipping bracket is required only when the rack is shipped with the MSA500 system installed.

7. Use the shipping bracket to secure the system in the rack for shipping:
 - a. Loosen the thumbscrew on the shipping bracket.
 - b. Slide the shipping bracket forward until it engages the storage system chassis.



- c. Tighten the thumbscrew.

Installing Hardware Options

Install any hardware options before initializing the system. For options installation information, refer to the option documentation or refer to Chapter 3, “Hardware Options Installation.”

System Cabling

After installing the system in a rack, connect the SCSI cables and power cords to the rear panel.

SCSI Cabling Guidelines

Always be sure that the servers attached to the storage system are powered down and power cords are disconnected before connecting SCSI cables.

IMPORTANT: Before installing the Smart Array Multipath software on a server with a Microsoft operating system, connect only one of the SCSI cables from each server to the MSA500 system. Leave the second SCSI cable for the redundant path disconnected until after the multipath software is installed.

For SSP cabling configurations, refer to “Selective Storage Presentation” in Chapter 4.

Power Cords

The power cords should be approved for use in your country. The power cord must be rated for the product and for the voltage and current marked on the electrical ratings label for the product. The voltage and current rating of the cord should be greater than the voltage and current rating marked on the product. In addition, the diameter of the wire must be a minimum of 1.00 mm² or 18 AWG. If you are using 18 AWG, your maximum length may be up to 12 ft.



WARNING: To reduce the risk of electric shock or damage to the equipment:

- **Do not disable the power cord grounding plug. The grounding plug is an important safety feature.**
 - **Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.**
 - **Unplug the power cord from the power supply to disconnect power to the equipment.**
 - **Do not route the power cord where it can be walked on or pinched by items placed against it. Pay particular attention to the plug, electrical outlet, and the point where the cord extends from the system.**
-

To connect AC power cords:

1. Connect the power cords to the power supplies.
2. Connect the power cords to the AC outlet.

For information about connecting DC power cords, refer to “DC Power Supply Option” in Chapter 3.

System Power Up

Observe the following guidelines before powering up the system:

- Be sure that all components are powered down.
- Always install all components of the storage system and connect components to the supported interconnect options.
- Install hard drives in the MSA500 system so the controller can identify and configure them at power up.



CAUTION: You must power up the MSA500 system before powering up the servers. It may take up to 2 minutes for the system to completely power up. Wait until the display provides the “Startup Complete” message.

To power up the system:

1. Complete server hardware installation and cabling. Refer to the server documentation.
2. Connect the SCSI cables and power cords to the MSA500 system. Refer to “System Cabling” in this chapter.

IMPORTANT: When the power cord is connected to the AC or DC source, the system automatically enters standby mode and provides power to certain system components.

3. Press the Power On/Standby button on the MSA500 system and observe the system power LED and controller display. When the system goes from standby to full power, the system power LED illuminates solid green, and the display provides a “Startup Complete” message.
4. Power up the servers. Refer to the server documentation.

Controller Display

Each MSA500 array controller in the MSA500 system contains an integrated LCD display. This module displays informational and error messages, shows the current status of the module, and provides an interface for user input. The system combines traditional POST messages issued by PCI-based array controllers with runtime event notification messages for this new set of controller display messages. The display module consists of the following components:

- A two-line, 20-column display text window
- Four buttons
- Two LEDs

Types of Messages

The display module is capable of storing up to 100 messages. When the message log is full, the system deletes the oldest message to make room for the most recent one.

The types of messages include:

- **Error Messages**—Error messages indicate a problem that may require user action.

The Fault LED illuminates when you view an error message. It also illuminates to indicate that an unviewed error message is in the queue and was followed by other types of messages. When scrolling backwards to view all error messages, the LED illuminates only when an error message is in the text display window.

- **Informational Messages**—Informational messages provide feedback on non-critical changes.
- **User Input Messages**—User input messages indicate an issue that requires a choice. The user can choose a selection before the end of a time-out period or allow the controller to default to a standard choice. User input messages only occur during system power up.

The Fault LED flashes when a user input message is in the text display window and requires input. If the user does not provide input within the time-out period, the message remains, but the LED stops flashing.

For a complete list of messages and their meanings, refer to Appendix C, “Display Messages.”

Using the Interface

- **Scrolling**—To view older messages, scroll backwards with the Up button (indicated by the up arrow). To view newer messages, scroll forwards with the Down button (indicated by the down arrow).

The arrival of new messages supersedes the display of any previous messages. When a new message arrives, the display ignores its previous scrolling position and presents the new message.

- **Selecting User Input Options**—User input messages present the user with a choice and define the options in the text display window. Select one of the options by pushing the left button (indicated by the left arrow) or the right button (indicated by the right arrow).
- **Deleting Messages**—To delete a message, scroll to the message, then press the left and right buttons simultaneously.

For information about controller LEDs, refer to Chapter 1, “Component Identification.”

Hardware Options Installation

Before installing hardware options, be sure to update the system with the latest firmware, as needed. For ROM flash software, refer to Chapter 4, “Configuration and Utilities.” For firmware and software updates, refer to the HP website

www.hp.com/products/serverstorage

System Power Down

For some option installation procedures, you must power down the system.

To power down the system:

1. Power down any attached servers. Refer to the server documentation.
2. Press the Power On/Standby button on the storage system. Wait for the system power LED to go from green to off.
3. Disconnect the power cords.

Hot-Plug SCSI Hard Drive Options

Observe the following guidelines when adding SCSI hard drives:

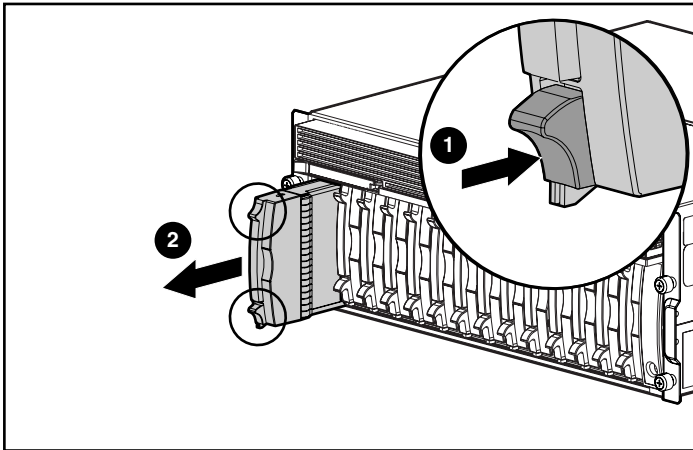
- If only one SCSI hard drive is used, install it in the bay with the lowest number.
- Hot-plug hard drives must be 1-inch universal SCSI types.
- Drives must be the same capacity to provide the greatest storage space efficiency when drives are grouped together into the same drive array.

Removing Hard Drive Blanks



CAUTION: Always populate bays with either a component or blank. Proper airflow can be maintained only when the bays are populated. Operating the system with unpopulated bays can lead to improper cooling and thermal damage.

To remove a hard drive blank:



To install a blank, align the blank with the empty bay and push the blank inward until it locks into place.

Replacing Hot-Plug SCSI Hard Drives



CAUTION: If you must replace a hot-plug drive, follow the guidelines in this section. Failure to do so can result in data loss and can void the warranty.

RAID 0 is not a fault-tolerant configuration. Never remove a drive from a RAID 0 array unless it has failed. Drive failure is indicated by an amber drive failure LED. In a RAID 0 configuration, removal of an operating drive results in data loss. To remove a drive without losing data, always back up the entire array, replace the drive, and restore the entire array. Backing up a single drive and replacing it does **not** restore the array.

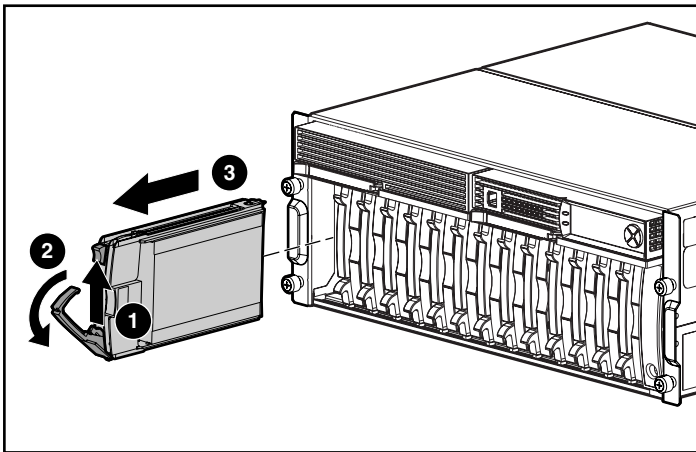
Some instances exist in which you may replace a drive in RAID 1, 5, and ADG configurations. To determine when drive replacement is possible without data loss, use the hot-plug SCSI hard drive LEDs combination table in Chapter 1, “Component Identification.”

Follow these additional guidelines when replacing drives:

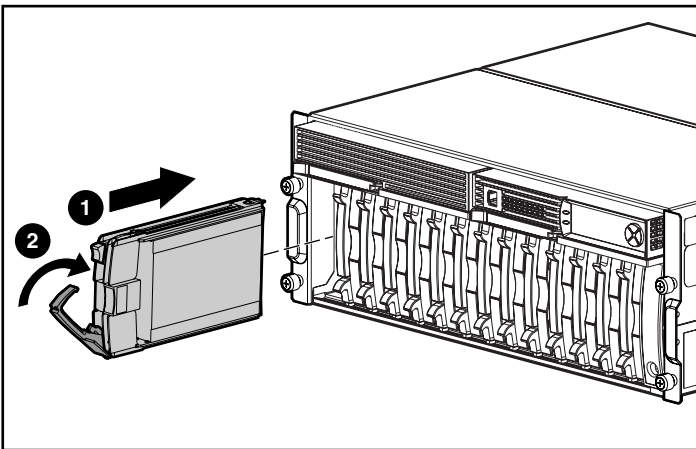
- **Never remove more than one drive at a time (or two drives if you are using ADG).** When you replace a drive, the controller uses data from the other drives in the array to reconstruct data on the replacement drive. If you remove more than one drive, a complete data set is not available to reconstruct data on the replacement drive(s) and permanent data loss could occur.
- **Never remove a drive while the controller is rebuilding another drive.** Each drive has an online LED that flashes green while the drive is being rebuilt. The controller requires the data from all other drives to rebuild the replacement drive.
- **If the system has an online spare drive, wait for it to complete rebuilding before replacing the failed drive.** When a drive fails, the online spare becomes active and begins rebuilding as a replacement drive. After the online spare has completed Automatic Data Recovery (the online LED is continuously lit), replace the failed drive with a new replacement drive. Do not replace the failed drive with the online spare. The system automatically rebuilds the replacement drive and resets the spare drive to an available state.
- **If you replace a drive while the system is off, it may be necessary to rebuild the replaced drive.**

To replace a drive:

1. Be sure that the online and activity LEDs on the failed drive are both off.
2. Remove the failed drive.



3. Install the new replacement drive.



CAUTION: Data loss can occur if the drive is not firmly seated.

4. Be sure that the drive LEDs illuminate one at a time and then turn off together to indicate that the system has recognized the new drive.

In fault-tolerant configurations, allow the replacement drive to be reconstructed automatically with data from the other drives. While reconstruction is in progress, the online LED flashes.

Universal Hot-Plug Tape Drive Option

The MSA500 system supports the Universal Hot-Plug Tape drive (AIT and DDS-4 types) for data storage and backup. The option supports Microsoft and Novell operating systems in various configurations.

For specific Universal Hot-Plug Tape drive configurations, refer to the HP website www.hp.com/products/sharedstorage

When installed, the hot-plug tape drive fills two storage system hard drive bays. For complete information, refer to the documentation that ships with the Universal Hot-Plug Tape drive.

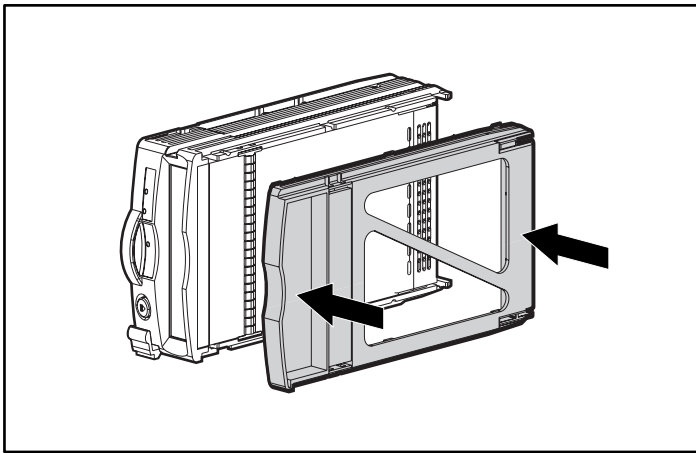
To install a tape drive:

1. Remove two adjacent hard drive blanks. Refer to “Removing Hard Drive Blanks” in this chapter.



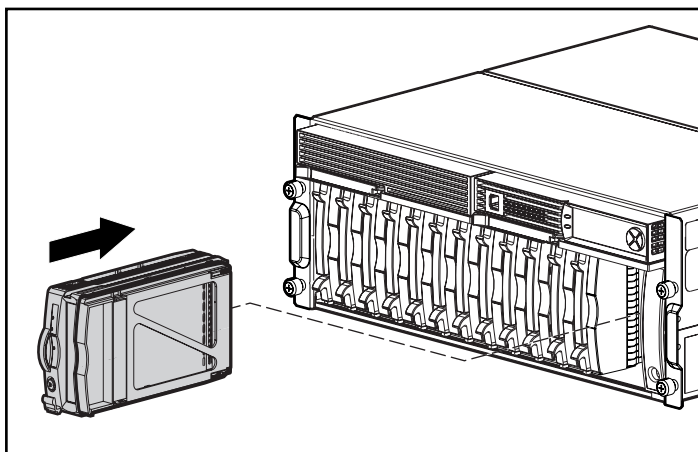
CAUTION: Installation of the tape drive height converter is permanent. Attempting to remove the converter after installation voids the tape drive warranty.

2. Install the tape drive height converter on the tape drive.



NOTE: Hot-plug tape drives have a 1.6-inch form factor. Most hot-plug drive cages have a 1-inch spacing between drive slots. When placing a 1.6-inch tape drive into a cage that has 1-inch spacing, you must completely fill two slots in the drive cage to maintain proper airflow. The drive height converter fills the remaining 0.4-inch.

3. Install the tape drive.



CAUTION: Data loss can occur if the drive is not firmly seated.

4-Port Shared Storage Module Option

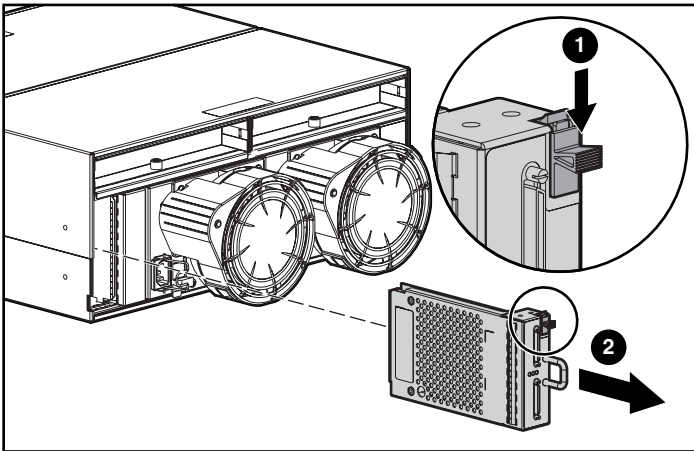
The MSA500 system ships standard with a 2-Port Shared Storage Module. To upgrade the unit and enable data transfer through four SCSI ports, install the optional 4-Port Shared Storage Module.

IMPORTANT: Before installing the 4-Port Shared Storage Module option, always upgrade to the most recent firmware for the server host bus adapters (HBAs) and the MSA500 Controllers. The firmware upgrades ensure that HBAs can negotiate I/O paths with the storage system controllers. For the most recent firmware, refer to the software CD that ships with the Smart Array Multipath Software CD or refer to www.hp.com.

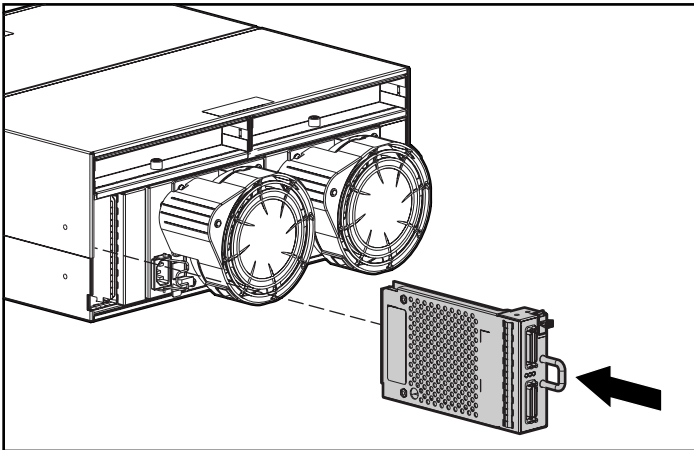
To install the module:

1. Power down the system. Refer to “System Power Down” in this chapter.
2. Disconnect the SCSI cabling connected to the 2-Port Shared Storage Module.

3. Remove the 2-Port Shared Storage Module.



4. Install the 4-Port Shared Storage Module.



HP StorageWorks Modular Smart Array 500 Controller Option

The system ships with one MSA500 controller. To provide redundancy and maximize storage system uptime, install a second Smart Array controller.

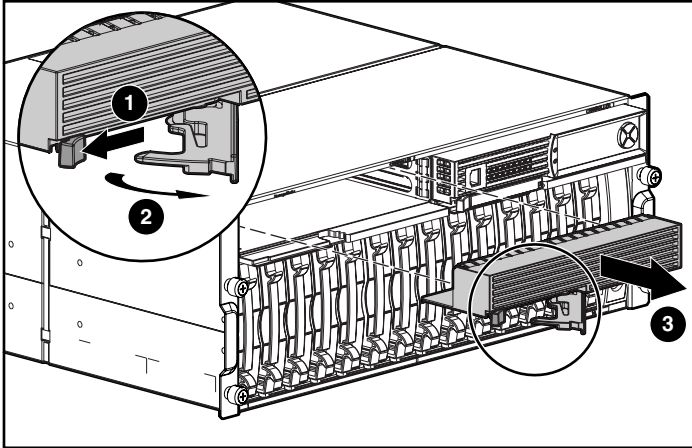
Observe the following guidelines:

- If a controller has more than one cache DIMM, be sure that both DIMMs have the same memory capacity.
- Always upgrade the cache in both controllers in a system with redundant controllers.
- In a system with a redundant controller, be sure that both controllers have the same number of DIMMs and that all DIMMs have the same memory capacity.
- To configure a MSA500 system for controller redundancy, both controllers must execute the same version of firmware. If the controllers have different firmware versions, the system responds as follows:
 - In a hot-plug addition of the second controller, the system clones the firmware version of the active controller onto the second controller. After the second controller is reset, the controllers become redundant.
 - In a non-hot-plug addition of the second controller, the system examines the firmware versions of both controllers at power up and clones the most recent version from one controller to the other controller.

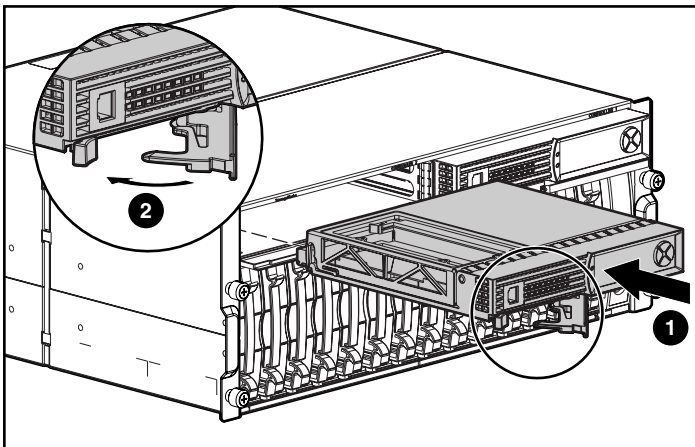
For more information about upgrading firmware, refer to Chapter 4, “Configuration and Utilities.”

To install an array controller:

1. Remove the bezel blank.



2. Open the locking latch on the redundant controller.
3. Install the controller.



4. Verify that the controller is seated properly by observing the controller LEDs. When seated properly, the LEDs illuminate when the system is powered.

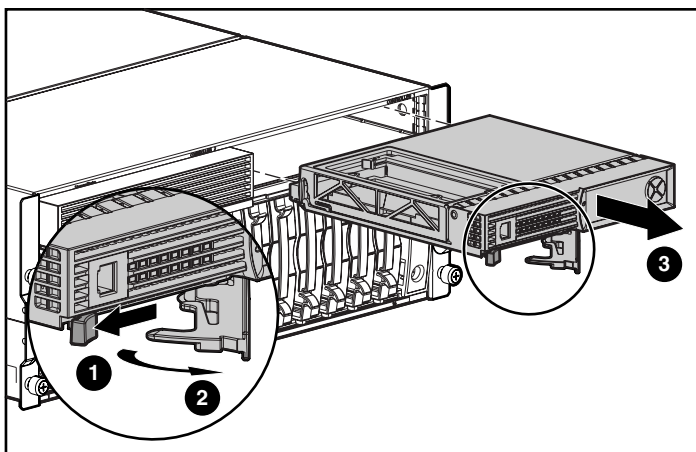
Cache Upgrade Option

The controller ships with a 128-MB battery-backed cache module. A 256-MB battery-backed cache module is available as an option. Before installing a cache upgrade, observe the following guidelines:

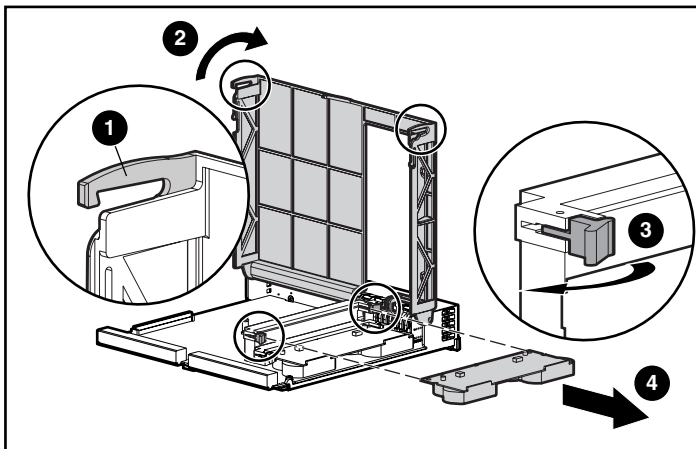
- Always power down the system before performing a cache upgrade.
- If a controller has more than one cache DIMM, be sure that both DIMMs have the same memory capacity.
- Always upgrade the cache in both controllers in a system with redundant controllers.
- In a system with a redundant controller, be sure that both controllers have the same number of DIMMs and that all DIMMs have the same memory capacity.

To upgrade the cache:

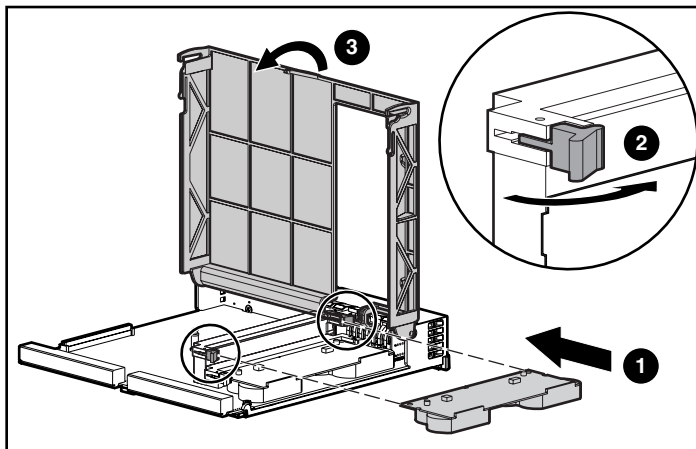
1. Power down the system. Refer to “System Power Down” in this chapter.
2. Remove the controller.



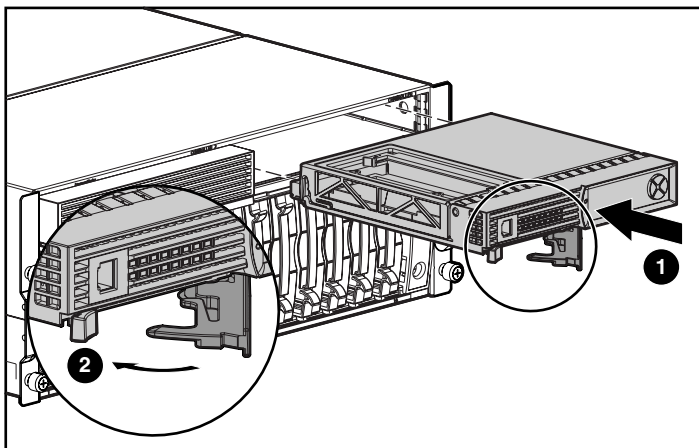
3. Remove the existing cache module.



4. Install the new cache module.



5. Install the controller.



6. Power up the system. Refer to “System Power Up” in Chapter 2, “Installation and Operation”.
7. Verify that the controller is seated properly by observing the controller LEDs. When seated properly, the LEDs illuminate when the system is powered.

DC Power Supply Option

The DC power supply procedure provides instructions for converting an existing AC power supply configuration to a DC power supply configuration.

Observe the required safety guidelines for DC power supply installation.



WARNING: A risk of personal injury from electric shock and hazardous energy levels exists. The installation of options and routine maintenance and service of this product must be performed by individuals who are knowledgeable about the procedures, precautions, and hazards associated with DC power products.



WARNING: To reduce the risk of electric shock, fire, and damage to the equipment, this product must be installed in accordance with the following guidelines:

- This power supply is intended only for installation in HP equipment located in a restricted access location.
- This power supply is not intended for direct connection to the DC supply branch circuit. It should be connected to a power distribution unit (PDU) that provides an independent overcurrent-protected output for each DC power supply. Each output overcurrent-protected device in the PDU must be suitable for interrupting fault current available from the DC power source and must be rated no more than 20A.
- This power supply is designed to be connected only to a DC power source that can be classified as SELV or TNV, in accordance with applicable national requirements for Information Technology Equipment and Telecommunications Equipment. Generally, these requirements are based on the International Standard for Information Technology Equipment, IEC 60950, and/or the European Telecommunication Standard ETC 300 132-2. The DC source is to have one pole (Neutral/Return) reliably connected to earth ground in accordance with local/regional electric codes and/or regulations.
- The green/yellow lead of the power cord assembly must be connected to a suitable ground/earth terminal located within the rack or cabinet. This terminal must be connected to a suitable building ground/earth terminal in accordance with local/regional electric codes/regulations. Do not rely on the rack or cabinet chassis to provide adequate ground/earth continuity.



WARNING: The blower blades rotate at a high speed and do not stop immediately when power is removed. Avoid touching the rotating blades when removing the blower.



CAUTION: Do not operate the storage system with one AC power supply and one DC power supply installed.



CAUTION: To prevent improper cooling and thermal damage, do not operate the storage system unless both bays are populated with a power supply.

To install a DC power supply:

1. Power down the system. Refer to “System Power Down” in this chapter.
2. Determine the required length of the DC power cord:



WARNING: To reduce the risk of electric shock or damage to the equipment, do not connect the power cord to the power supply until the power supply is installed.

- a. Place the power supply end of the DC power cord near the power supply bay. Do not plug the DC power cord into a power supply.
 - b. Route the power cord to a PDU or other suitable DC power source. Do not plug the DC power cord into the power source.
 - c. Trim the DC power cord as required.
3. Connect the free end of the DC power cord to the PDU or other suitable DC power source.
4. Connect the free end of the green/yellow safety cable to a suitable earth ground.

IMPORTANT: If the power supply fails to operate, the red and black cables may be connected incorrectly. When connected properly, the black cables should be at a higher potential (more positive) relative to the red cable. The power supply features reverse polarity protection so that no damage occurs if the power supply is connected incorrectly.

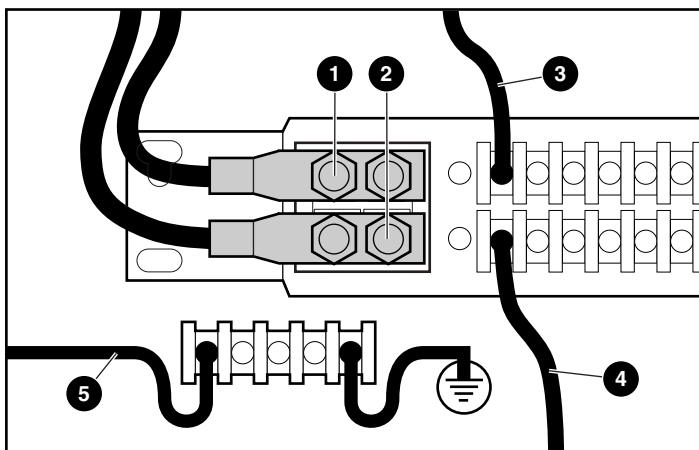
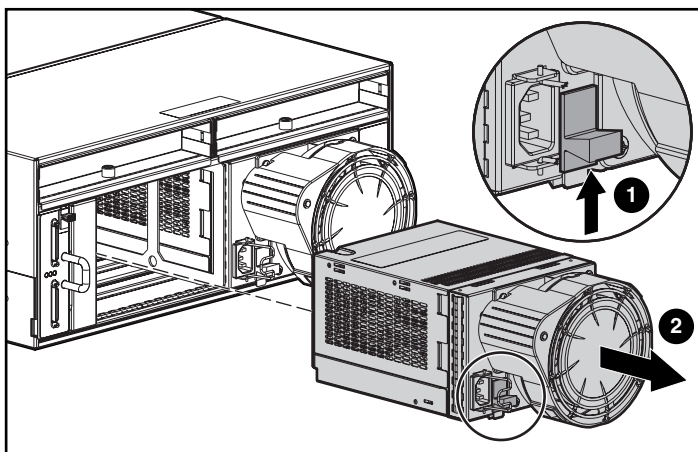


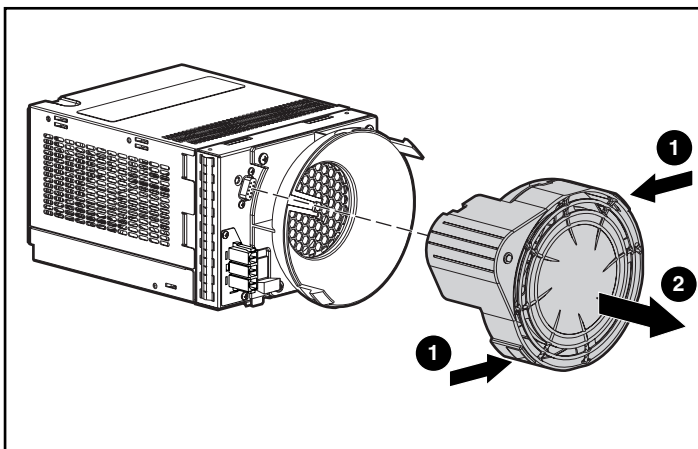
Table 3-1: DC Cabling Configuration

Item	Description
1	-48 VDC cable from facility power source
2	-48 V return cable from facility power source
3	Red cable from power supply
4	Black cable from power supply
5	Green/yellow cable from power supply connecting to rack chassis terminal block

5. Remove the existing AC power supply, if installed.



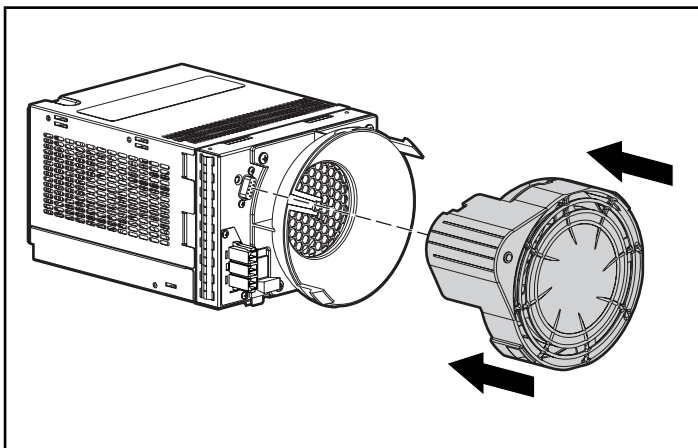
6. Remove the blower from the AC power supply.



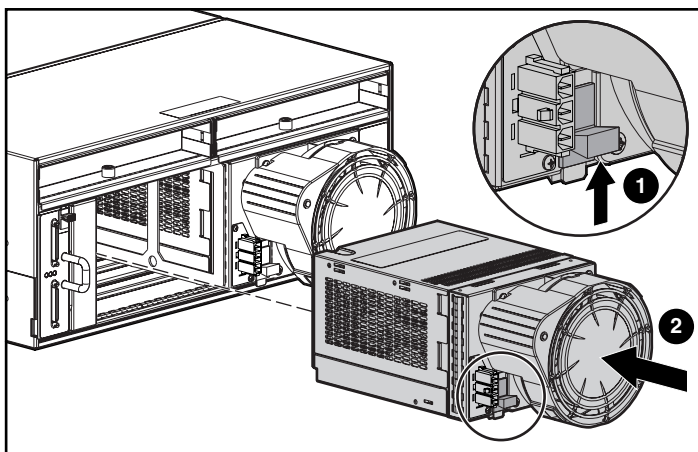


CAUTION: Do not press on the center section of the blower because this action can damage the blades. Press only on the outer edge of the blower.

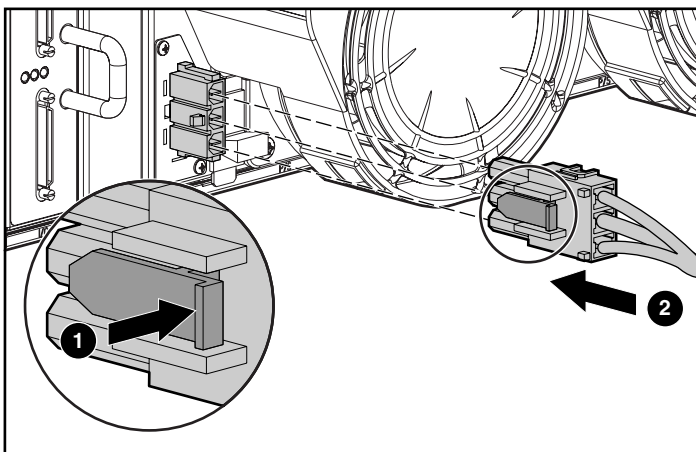
7. Install the blower on the DC power supply.



8. Remove the protective cover from the connector pins on the DC power supply.
9. Slide the DC power supply into the bay.



10. Connect the DC power cord to the power supply.



11. Repeat steps 2 through 10 to install the second DC power supply.
12. Power up the system. Be sure that the power supply/blower assembly LED and system power LED are green.

Configuration and Utilities

Server Utilities

HP utilities provide reporting functions that enable event-focused management and diagnostics. To install and run these utilities, refer to the server documentation.

- **Diagnostics Utility**—This utility tests and verifies proper operation of the system hardware. If problems are found, the utility isolates failure(s) down to the replaceable part, whenever possible. When an operating system is installed with SmartStart Version 5.30 or later, the Diagnostics and utilities are installed on a partition of the hard drive that contains the operating system. (This hard drive may or may not be located in the storage system.) Always access these utilities when a system configuration error is detected during POST.
- **INSPECT Utility**—This utility provides a report detailing system information.
- **Insight Manager 7**—This Web-based application enables system administrators to accomplish normal administrative tasks from any remote location, using a Web browser. Insight Manager 7 provides device management capabilities that consolidate and integrate management data from HP and third-party devices.
- **Insight Management Agents**—These agents enable easy manageability of the server through Insight Manager 7 software and third-party SNMP management platforms. Management agents monitor key subsystems that are instrumental in making health, configuration, and performance data available to the agent software. The agents act upon that data by initiating alarms in the event of faults. The agents also provide updated management information, such as network interface or subsystem performance statistics, to the management systems.

- **Survey Utility**—This utility gathers critical hardware and software information on servers running Microsoft Windows and Novell NetWare operating systems. If a significant change occurs between data-gathering intervals, the Survey Utility marks the previous information and overwrites the Survey text files to reflect the latest changes in the configuration.

Recovery Server Option

The HP ProLiant Essentials Recovery Server Option (RSO) software kit supports a standby recovery server configuration. This configuration comprises two identical (and identically configured) ProLiant servers connected to a common MSA500 system and a common network. One of the servers (the primary) supports network clients by default. The other server remains in a preboot stage during normal use and acts as a backup (recovery) server. All hard drive storage is located in the shared storage system. The storage system also contains a single copy of the operating system and all the applications, drivers, and data.

When a system fault occurs in either the server or operating system, RSO automatically takes the primary server offline and initializes the recovery server to take over operations. While the recovery server is supporting network clients, the primary server can be repaired at leisure.

For more information about configuring RSO, refer to the *HP ProLiant Essentials Recovery Server Option User Guide* that ships with the software.

For installation procedures, refer to the *HP ProLiant Essentials Recovery Server Option Pack Installation Instructions* that ships with the software.

ROM Functions and Utilities

Each MSA500 controller has a ROM that contains the controller firmware.

Recovery ROM

The Recovery ROM feature stores two complete firmware images in the ROM: one active image and one backup image. When the controller is powering up, it checks both firmware images to be sure they are valid. If either image is invalid, the system overwrites the invalid image with the valid image. This process, commonly called auto-flashing, is performed automatically by the controller and does not require any user intervention. The controller display provides messages for the status of this process.

Firmware Upgrades

The ROM flash tool enables system administrators to efficiently upgrade array controller ROM images. This tool has the following features:

- Supports Microsoft® Windows NT® 4.0, Windows® 2000, Novell NetWare (offline only), and Linux operating systems
- Integrates with other software maintenance, deployment, and operating system tools
- Automatically checks for hardware, firmware, and operating system dependencies, and installs only the correct ROM upgrades required by each target controller

For firmware procedures, refer to the SmartStart CD.

Controller Firmware Auto Cloning

In a redundant controller configuration, both controllers must execute the same version of firmware. During power up (or when a redundant controller is installed as a hot-plug procedure), the system compares the controller firmware versions. If the versions differ, the controller displays a user input message seeking to initiate Controller Firmware Auto Cloning. If 60 seconds elapse with no user input, cloning begins automatically, and the system overwrites one firmware version with the other version.

When the cloning is complete, the system resets the modified controller. After the modified controller powers up, the controllers begin operating in redundant mode.

The system clones firmware based on the following criteria:

- **Non-Hot-Plug Cloning**—If the system powers up with both controllers installed, the system clones the most recent firmware version from either controller.
- **Hot-Plug Cloning**—If the system is operating and an optional redundant controller is installed, the system clones the firmware version from the primary controller, regardless of which firmware version is more recent. This cloning method ensures that all host-initiated I/O remains uninterrupted during system operation.
- **Incompatible Version Cloning**—If a specific version of firmware is incompatible with certain hardware revisions of a controller, the system displays the user input message seeking to initiate Controller Firmware Auto Cloning and clones the most recent firmware version that is compatible with both controllers.

IMPORTANT: During incompatible version cloning, the system does not reset the updated controller if the controller is operating and processing I/O. In this case, the system does not enter redundant mode and provides an informational message on the controller display. To configure redundancy, cycle the system power. Refer to “System Power Down” in Chapter 3.

Selective Storage Presentation

SSP is a controller firmware feature that enables the administrator to control access from multiple hosts to logical drives on the MSA500 system. The administrator selects which server host or hosts can access the stored data, restricting access as needed to assure data integrity and security.

Each logical drive on the controller has an access control list that contains the IDs of the server host adapters that have access to the drive. If a server attempts to send commands to a logical drive without access authority, the controller rejects the command.

The configuration utility maps the IDs of server host adapters to connection names and sets up access control lists for logical drives based on the adapter IDs.

SSP Hardware Configurations

To configure the hardware for SSP, use SCSI cables to connect each server to the 2-Port or 4-Port Shared Storage Module installed in the storage system. Boot volumes for individual servers can reside on server drives or storage system drives.

Firmware Requirements

For Selective Storage Presentation (SSP) support on the MSA500 system, be sure the following firmware versions are present:

- MSA500 Controller firmware Version 1.66 or later
- Smart Array 532, 5i, or 5i+ Controller firmware Version 2.36 or later

For the most recent firmware, refer to the software CD that ships with the MSA500 system or refer to

www.hp.com

Enabling SSP

After choosing the configuration that best suits your needs, enable SSP with ACU Version 6.0 or later. Locate ACU on the SmartStart CD. For instructions, refer to the *HP Array Configuration Utility User Guide* on the Documentation CD.

Array Configuration Utility

ACU Version 6.0 (or later) is a browser-based utility with the following features:

- Supports online array capacity expansion, logical drive capacity extension, assignment of online spares, and RAID or stripe size migration
- Suggests the optimum configuration for an unconfigured system
- Provides different operating modes, enabling faster configuration or greater control over the configuration options
- Remains available any time that the server is on
- Displays on-screen tips for individual steps of a configuration procedure

The minimum display settings for optimum performance are 800 × 600 resolution and 256 colors. The server must have Microsoft Internet Explorer 5.5 (with Service Pack 1) installed and be running Microsoft Windows 2000, Windows NT 4.0, or Linux. Refer to the *README.TXT* file for further information about browser and Linux support.

For more information about ACU Version 6.0 (or later), refer to the *HP Array Configuration Utility User Guide* on the Documentation CD.

Moving Array Controller Drives and Arrays



CAUTION: Back up all data before removing drives or changing configurations. Failure to do so could result in permanent loss of data. Before moving drives and arrays, run ACU.

Drives can be moved to other ID positions on the same array controller. You can also move a complete array from one controller to another, even if the controllers are on different servers or storage devices. Arrays on different controllers can also be moved to another controller.

Before moving drives, observe the following requirements:

- No drives are failed, missing, or degraded.
- The move does not result in more than 14 physical drives.
- No more than 32 logical volumes are configured for a controller.
- The array must be in its original configuration with no active spare drives.
- Capacity expansion is not running.
- Controller firmware is the latest version (recommended).
- Controller is a Smart Array controller.

Before moving an array from one controller to another, observe these additional requirements:

- All drives in the array must be moved at the same time.
- Drive positions of the destination controller must match original drive positions.

When all requirements are met:

1. Power down the system. Refer to “System Power Down” in Chapter 3.
2. Move the drives. Refer to “Hot-Plug SCSI Hard Drive Options” in Chapter 3.
3. Power up the system. Refer to “System Power Up” in this chapter.

A #86 controller display message should appear, indicating that drive positions were changed and the configuration was updated. If a #121 controller display (no volumes) message is displayed, power down the system immediately to avoid data loss, and return the drives to their original locations.

For more information about display messages, refer to Appendix C, “Display Messages.”

4. Check the new drive configuration by running ACU. Refer to the *HP Array Configuration Utility User Guide* on the Documentation CD.

Expanding and Extending Capacity



CAUTION: Back up all data before removing drives or changing configurations. Failure to do so could result in permanent loss of data. Before moving drives and arrays, run ACU.

Array Capacity Expansion is the addition of physical drives to an array that has already been configured. The capacity of these added physical drives may then be added to an existing logical drive on the array (capacity **extension**; refer to the next paragraph), or it may be configured into a new logical drive.

Logical Drive Capacity Extension is the enlargement of an existing logical drive after the corresponding array has undergone capacity expansion.

Use ACU to perform capacity expansion and extension. A data backup and restoration cycle is not required, even in non-fault-tolerant configurations.

With hot-plug drives, you can perform expansion online. Online **extension** is only possible with operating system support.

IMPORTANT: When extending a logical drive under Microsoft Windows 2000, upgrade the disk to DYNAMIC **before** creating a partition on that disk. If the disk already has a partition when it is upgraded to DYNAMIC, Windows 2000 may not allow logical drive extension. **Refer to the Windows 2000 documentation for details about DYNAMIC and BASIC disks.**

IMPORTANT: Microsoft Windows NT 4.0 only allows four partitions on each logical drive. Additional drive space created may not be accessible if the four partitions per logical drive limit are exceeded.

IMPORTANT: If you are running Microsoft Windows 2000 with Microsoft Cluster Services (MSCS), logical drive extensions are not recommended. MSCS requires that disks be configured as BASIC in logical disk manager. In order to take advantage of logical drive extension, the drives would have to be configured as DYNAMIC when the volume is initially created. Because of the differences in requirements for MSCS and the logical drive extension feature, we recommend you do not perform a logical drive extension on a storage enclosure that is part of a Microsoft Cluster.

Array Diagnostics Utility

ADU collects all possible information about the array controllers in the system and generates a list of detected problems. You can save this data to a file for analysis. In most cases, ADU provides sufficient information for troubleshooting procedures.

To obtain ADU, download the utility from the HP website

www.hp.com

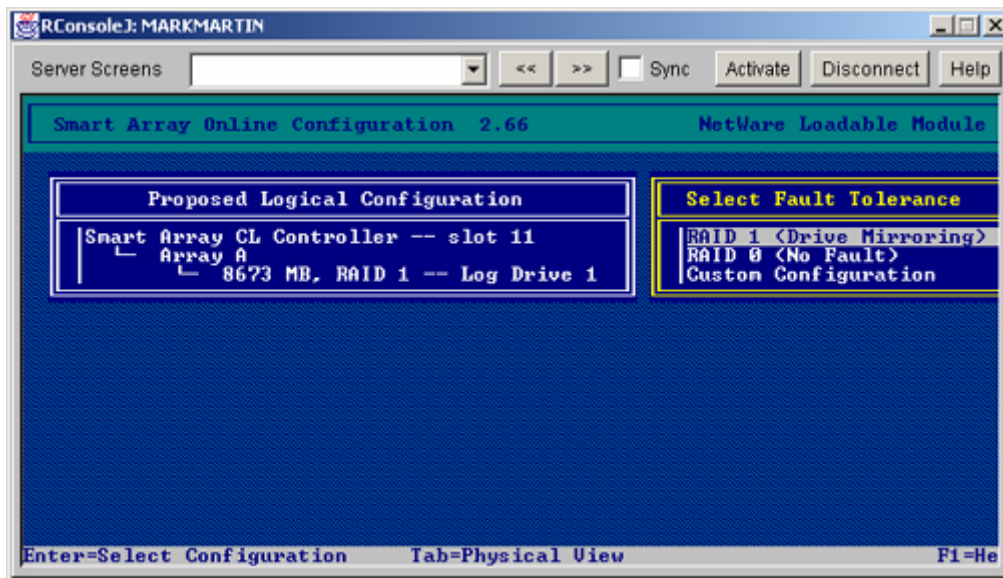
NetWare Online Array Configuration Utility (CPQONLIN)

The NetWare Online Array Configuration Utility, also called CPQONLIN, is a NetWare Loadable Module (NLM) for configuring drive arrays without shutting down the server. CPQONLIN also provides information about the status of drives attached to the MSA500 controller. It indicates drive failure, expansion, or waiting for expansion or rebuild (queued). Before loading *CPQONLIN.NLM*, you must load the appropriate device drivers—*CPQFC.HAM* and *CPQSHD.CDM*. *CPQONLIN.NLM* is located in the ONLINE directory of Novell SSD Disk 4.

IMPORTANT: CPQONLIN does not support SSP configurations. Use ACU 6.0 offline to enable SSP configurations in a NetWare environment.

Auto-configuration

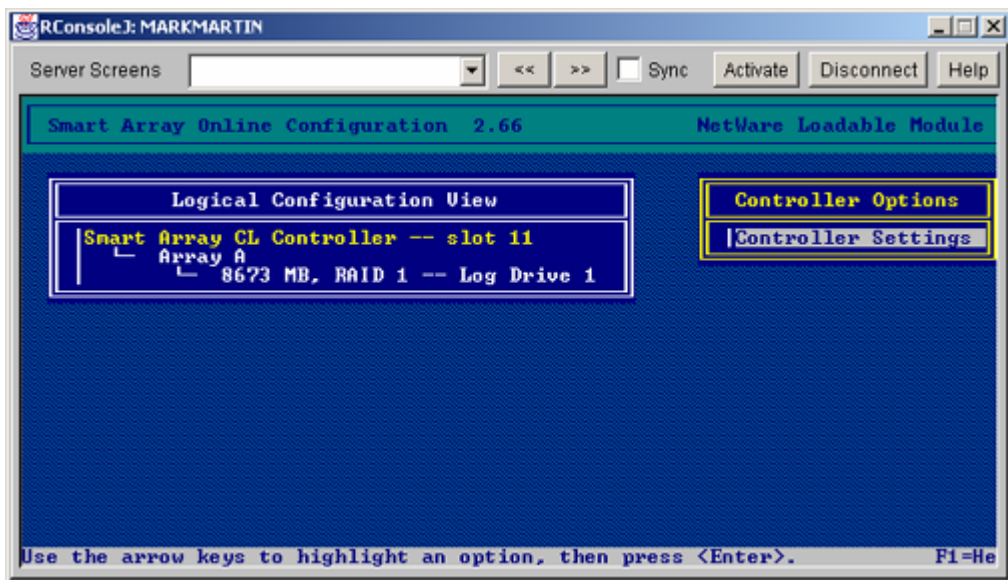
If no logical drives are configured, a CPQONLIN auto-configuration wizard appears and prompts you to select fault-tolerance information. CPQONLIN then configures arrays optimally for the selected fault tolerance.



Custom Configuration

Custom configuration allows you to create arrays and assign fault tolerance one array at a time. To custom configure an array:

1. Go to the **Main Configuration View** screen.
2. Highlight the controller, array, or logical drive to be configured.
3. Make a selection from the **Options** menu located on the right side of the screen. The following figure shows the controller highlighted on the left side of the screen and **Controller Options** menu on the right side of the screen.

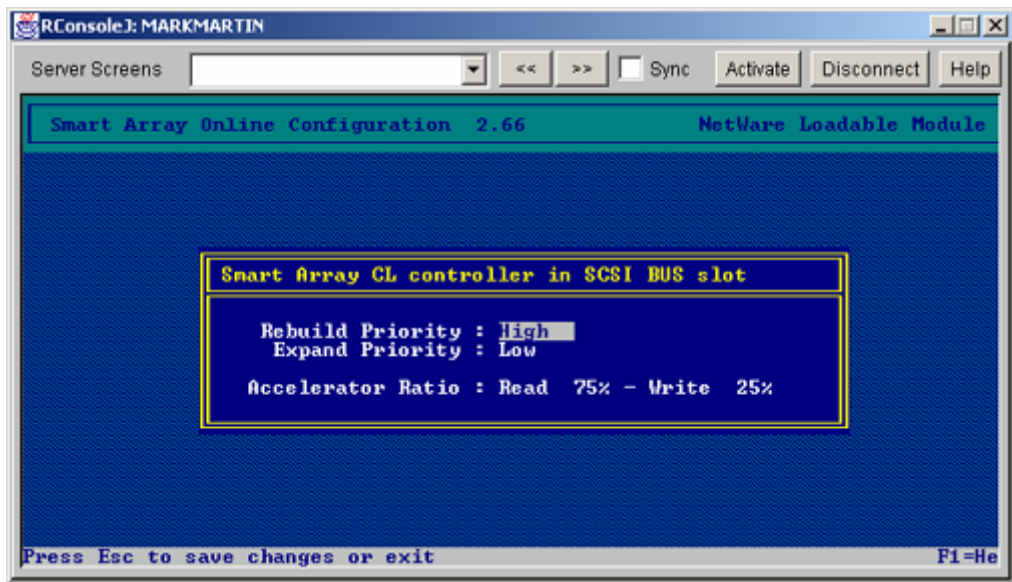


4. Use online help for on completing configurations. The following sections discuss CPQONLIN functions.

Drive Rebuild, Expand Priority, and Accelerator Ratio

To set the drive rebuild priority, expand priority, or accelerator ratio for a controller:

1. Go to the **Main Configuration View** screen.
2. Highlight the controller.
3. Select the **Controller Settings** option listed below **Controller Options**. The **Controller Settings** screen appears.



Drive Rebuild

Drive rebuild occurs after a physical drive fails and is replaced. Only logical drives configured for fault tolerance (RAID 1, RAID 5, ADG) on the array with the failed physical drive will rebuild.

Priority Settings

To set the drive rebuild priority:

1. Highlight the MSA500 controller.
2. Select the controller settings.
 - If you choose low priority for drive rebuild, drive rebuilding takes place when I/O to the drive is inactive.
 - If you choose high priority, drive rebuilding occurs faster, at the expense of normal I/O operations.

Accelerator Ratio

The MSA500 controller has an onboard cache called an Array Accelerator, which performs both write-posting and read-ahead caching. The setting in CPQONLIN determines the amount of memory allocated to the read and write caches. For example, if the Accelerator Ratio is set to Read 75%:Write 25%, 75% of Array Accelerator cache is dedicated to read-ahead cache and 25% is dedicated to the write-posting cache. This option can be modified from the controller **Settings** menu.

Expanding an Array

During an expand, performance may be slightly degraded. In most cases, however, any potential degradation is offset by the addition of physical drives. Some tips for expanding include:

- Perform the expand process during periods of low server use. If you must expand during peak periods, ACU for NetWare enables you to set the priority of the expand. Setting the priority to LOW affects performance the least, but it takes longer for the new space to become available.
- When expanding, always add drives with a capacity equal to or greater than the capacity of the smallest drive in the array. Adding larger drives wastes space because only the space that is equal to the smallest drive size can be used.

Adding or Configuring Spare Drives

When adding a spare drive to an array, there must be an unassigned drive or a drive already assigned as a spare on another array. You can assign a single spare to any number of arrays or assign separate spares. When you select **Assign Spare Drive**, only drives that qualify will appear (for example, only those spares that are large enough will appear). If drives that you expect to see do not appear, switch to the physical drive view (**Tab** key), and check the size of the drives. The capacity of the spare must be equal to or greater than the capacity of the smallest drive in the array.

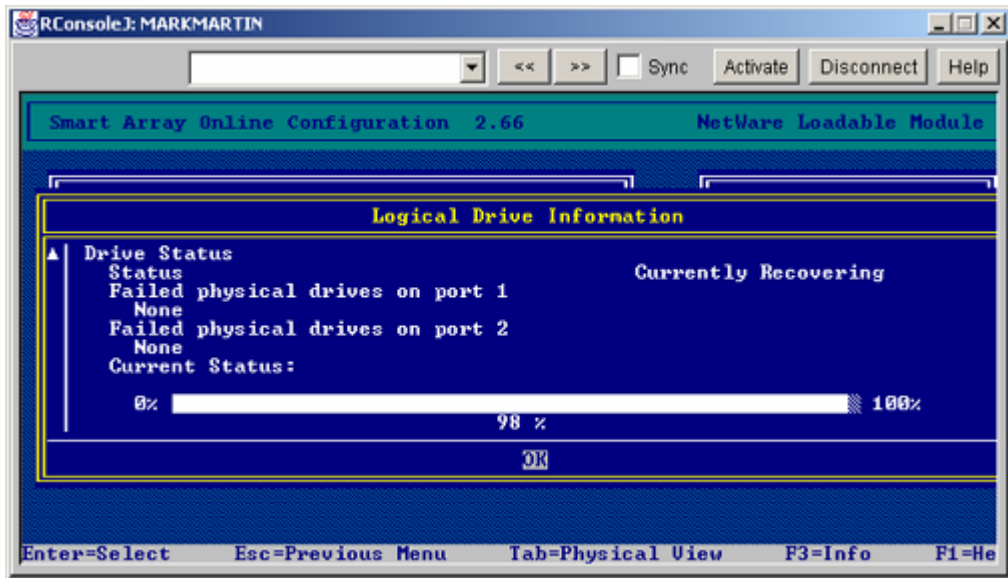
Online RAID and Stripe Migration

Using CPQONLIN, you can modify both the RAID level and stripe size of an existing logical drive while online. To migrate a drive:

1. Select the drive setting option under the logical drive menu for the drive you intend to modify.
2. Select the new RAID level and/or stripe size from the choices presented to you. If the new settings are valid, the migration will begin when you save the changes.

Failed Drives or Interim Recovery Mode

If a drive fails and hardware fault tolerance is enabled, operation continues. Replace the drive as soon as possible. Select a logical drive and press the **F3** key to monitor the status of drive recovery.



Drive status messages include:

- **Interim Recovery:** The logical drive is operating, but a failed drive has not been replaced. Replace drive as soon as possible.
- **Ready for Recovery:** The logical drives are queued for recovery. This status is displayed when another logical drive is already rebuilding or expanding.
- **Rebuilding:** The array is operating and rebuilding a replacement drive or an online spare, if one was assigned.
- **Logical Drive Failed:** If you have one or more logical drives that are not protected by fault tolerance in an array, the data on these logical drives will be lost. ACU shows the logical drives as FAILED. After drive replacement, any fault-tolerant logical drives rebuild. The logical drives that were not protected (FAILED) become available for data (the devices are reactivated automatically). If you have a backup of the data, restore the data now.

If you do not replace the failed drive, the only option using ACU is to delete logical drives. Do **not** delete logical drives that contain valid data. Doing so results in data loss.

NOTE: A failed status can occur on drives protected by fault tolerance if two or more physical drives fail concurrently.

Some status messages are available without pressing the **F3** key. For example, on the **Main** menu, the **FAILED** status appears next to the logical drive that has failed. **EXPANDING** and **REBUILDING** appear next to the array in which the activity is occurring.

Handling Disk Drive Failures

If the MSA500 controller was configured with hardware fault tolerance, complete the following steps after a disk drive failure.

1. Determine which physical drive failed. On hot-plug drives in a ProLiant server or storage system, failure is indicated by an amber drive failure LED on each drive tray.
2. If the unit containing the failed drive does **not** support hot-plug drives, perform a normal system shutdown.
3. Remove the failed drive and replace it with a drive that is of the same capacity. For hot-plug drives, after you secure the drive in the bay, the LEDs on the drive each flash once in an alternating pattern to indicate that the connection was successful. The online LED flashes, indicating that the controller recognized the drive replacement and began the recovery process.
4. Power up the server, if applicable.
5. The MSA500 controller firmware reconstructs the information on the new drive, based on information from the remaining physical drives in the logical drive. While reconstructing the data on hot-plug drives, the online LED flashes. When the drive rebuild is complete, the online LED is illuminated.
6. NetWare cannot detect a single physical drive failure when using hardware-based fault tolerance; NetWare determines that the data is still valid and accessible during the rebuilding process. However, the driver knows that a physical drive has failed. A message is printed on the console notifying the user that a physical drive is in a degraded state. CPQONLIN will also show the drive has failed.

Optimizing Array Controller Performance

To improve system performance, keep these tips in mind before creating NetWare volumes or partitions:

- If you selected a fault-tolerance option, such as mirroring or distributed data guarding, when using the System Configuration Utility, do not select mirroring while using *INSTALL.NLM*. The fault-tolerance capabilities of the MSA500 controller provide performance improvements and automatic data recovery features.
- Novell recommends creating volumes with a 64-KB block size and using the Block Sub-Allocation feature of NetWare. Using a large block size decreases the amount of RAM required to mount the volume, while Block Sub-Allocation allows NetWare to allocate disk space more efficiently.

Cluster Installation and Configuration

Cluster Hardware Installation

To install the cluster:

1. Select an installation site that meets the optimum environment requirements. Refer to the server documentation.
2. Install the storage system into the rack. Refer to Chapter 2, “Installation and Operation.”
3. Install the servers into the rack, directly above the storage system. Refer to the server documentation.

IMPORTANT: Do not power up the storage system or servers at this time.

4. Install options:
 - To install storage system options, refer to Chapter 3, “Hardware Options Installation.”
 - To install server options, refer to the server documentation or the documentation that ships with the option.
5. Cable the system:
 - a. Install the server cable management arms. Refer to the server documentation.

- b. Connect the VHDCI SCSI cables to the storage system and servers.

For Microsoft or Linux operating systems, connect the Ethernet crossover cable between the servers. Use the RJ-45 connectors identified as NIC 1 on each server.

- c. Connect peripheral devices, such as a keyboard, mouse, or monitor.

IMPORTANT: HP recommends the use of a KVM switchbox. Refer to the documentation that ships with the switchbox.

- 6. Connect the power cords.

IMPORTANT: HP recommends the use of an uninterruptible power supply (UPS). Contact the nearest authorized reseller.

- 7. Depending on the operating system, use the appropriate installation instructions provided on the HP website:

<http://www.hp.com/servers/proliant/highavailability>

Regulatory Compliance Notices

Regulatory Compliance Identification Numbers

For the purpose of regulatory compliance certifications and identification, this product has been assigned a unique series number. The series number can be found on the product nameplate label, along with all required approval markings and information. When requesting compliance information for this product, always refer to this series number. The series number should not be confused with the marketing name or model number of the product.

Federal Communications Commission Notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (for example, personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

Class A Equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of Conformity for Products Marked with the FCC Logo, United States Only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding this product, contact us by mail or telephone:

- Hewlett-Packard Company
P. O. Box 692000, Mail Stop 530113
Houston, Texas 77269-2000
- 1-800-652-6672 (For continuous quality improvement, calls may be recorded or monitored.)

For questions regarding this FCC declaration, contact us by mail or telephone:

- Hewlett-Packard Company
P. O. Box 692000, Mail Stop 510101
Houston, Texas 77269-2000
- 1-281-514-3333

To identify this product, refer to the part, series, or model number found on the product.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Modifications

The rating label on the device shows the classification (A or B) of the equipment. Class B devices have an FCC logo or ID on the label. Class A devices do not have an FCC logo or ID on the label. After you determine the class of the device, refer to the corresponding statement.

Canadian Notice (Avis Canadien)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union Notice

This product complies with the following EU Directives:

- Low Voltage Directive 73/23/EEC
- EMC Directive 89/336/EEC

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) which are listed on the EU Declaration of Conformity issued by Hewlett-Packard for this product or product family.

This compliance is indicated by the following conformity marking placed on the product:



This marking is valid for non-Telecom products and EU harmonized Telecom products (e.g. Bluetooth).



This marking is valid for EU non-harmonized Telecom products.

*Notified body number (used only if applicable—refer to the product label)

Japanese Notice

ご使用になっている装置にVCCIマークが付いていましたら、次の説明文をお読み下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

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BSMI Notice

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Laser Compliance

The GBIC Module contains a laser diode of either gallium aluminum arsenide (GaALAs) emitting in the wavelength range of 770 to 860 nm, or indium gallium arsenide phosphide (InGaAsP) emitting in the wavelength range of 1270 to 1355 nm. All HP systems equipped with a laser device comply with safety standards, including International Electrotechnical Commission (IEC) 825. With specific regard to the laser, the equipment complies with laser product performance standards set by government agencies as a Class 1 laser product. The product does not emit hazardous laser radiation.



WARNING: Use of controls or adjustments or performance of procedures other than those specified herein or in the laser product's installation guide may result in hazardous radiation exposure. To reduce the risk of exposure to hazardous radiation:

- Do not try to open the unit enclosure. No user-serviceable components are inside.
 - Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
 - Allow only HP Authorized Service technicians to repair.
-

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States. This device is classified as a Class 1 laser product as defined by IEC 825.



This indicates that the product is classified as a CLASS 1 LASER PRODUCT.

Battery Replacement Notice

The MSA500 system is provided with Lithium Manganese Dioxide or Vanadium Pentoxide batteries. A danger of explosion and risk of personal injury exists if the array is incorrectly replaced or mistreated. Replace only with the HP spare designated for this product. For more information about battery replacement or proper disposal, contact an authorized reseller or an Authorized Service Provider.



WARNING: The battery-backed cache module contains Lithium Manganese Dioxide or Vanadium Pentoxide batteries. A risk of fire and burns exists if the battery pack is not handled properly. To reduce the risk of personal injury:

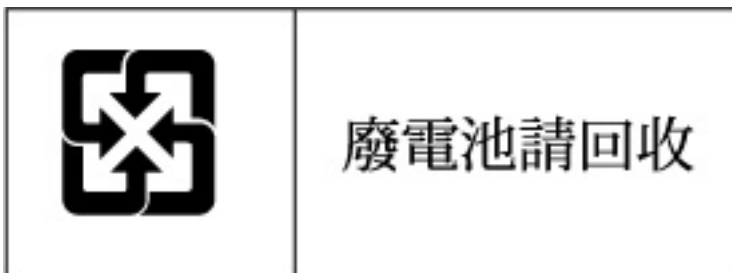
- **Do not attempt to recharge the battery.**
 - **Do not expose to temperatures higher than 60°C (140°F).**
 - **Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.**
 - **Replace only with the HP spare designated for this product.**
-



Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to HP, authorized HP Partners, or their agents.

Taiwan battery recycling notice

The Taiwan EPA requires dry battery manufacturing or importing firms in accordance with Article 15 of the Waste Disposal Act to indicate the recovery marks on the batteries used in sales, giveaway or promotion. Contact a qualified Taiwanese recycler for proper battery disposal.



Power Cord Statement for Japan

製品には、同梱された電源コードをお使い下さい。
同梱された電源コードは、他の製品では使用出来ません。

Electrostatic Discharge

To prevent damage to the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be sure you are properly grounded when touching a static-sensitive component or assembly.

Grounding Methods

Several methods for grounding exist. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ± 10 percent resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part.

For more information on static electricity or assistance with product installation, contact your authorized reseller.

Display Messages

The display message may specify a box number. Box 1 is the MSA500 system chassis.

Table C-1 defines display messages and provides the appropriate response, if action is required.

Table C-1: Display Messages

Message	Type	Description	Action
00 ARRAY CONTROLLER FIRMWARE VER <version>	Informational	Displays the current version of the firmware running on the array controller.	—
01 HP SMART ARRAY CL STARTUP COMPLETE	Informational	The array controller completed its power up sequence and is now operational.	—
02 ENABLE VOLUME <n>? '<'=NO, '>'=YES	User Input	An issue exists with a configured volume that may result in data loss. Refer to display messages for more information.	Selecting no or not selecting any option within the timeout period causes the controller to disable the volume, so the user can attempt to fix the issue. Selecting yes causes the controller to enable the volume regardless of the issue.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
03 CRITICAL LOCK-UP DETECTED. CODE=<n>h	Error	Array controller firmware detected a critical error. To prevent any possible data loss, the firmware has entered a lock-up state. The code contains engineering-specific information about the lock-up condition. Contact HP support.	<ol style="list-style-type: none"> 1. Remove the failing array controller. 2. Wait 10 seconds. 3. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>
04 ENABLE VOLUMES ? '<'=NO, '>'=YES	User Input	An issue exists with all configured volumes that may result in data loss.	Refer to display messages for more information.
05 SYSTEM NAME: <name>	Informational	Displays the user assigned name for the MSA500 system. This name can be assigned using ACU.	—
06 RESTARTING SYSTEM	Informational	Indicates that the system has been reset and is being restarted.	—
07 CLONE FIRMWARE? '<=NO,' '>=YES	User Input	The controller is attempting to enter redundant mode but needs to clone the firmware. The controller is requesting confirmation from the user to overwrite the current firmware with the version from the redundant controller.	<p>If the user selects YES, the firmware is cloned.</p> <p>If the user selects NO, the firmware disables the controller.</p> <p>If the user does not respond within 60 seconds, the controller clones the firmware.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
08 FIRMWARE FLASH FAILED	Error	The active controller was unable to clone the firmware onto a redundant controller after two consecutive attempts.	Remove the failed controller.
20 INITIALIZING SCSI SUBSYSTEM	Informational	The SCSI subsystem is being initialized as part of the power on sequence.	—
21 SCANNING FOR SCSI DEVICES	Informational	The controller is scanning for hard drives.	—
22 INITIALIZING SCSI DEVICES	Informational	The controller is initializing the hard drives.	—
24 BAD SCSI BUS MODE NON-LVD DEVICE FOUND	Error	The MSA500 system does not support SCSI Single Ended (SE) devices; it only supports SCSI Low Voltage Differential (LVD) devices.	<ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Examine all attached SCSI devices. 3. Remove any SE devices found and replace them with LVD devices.
30 I2C READ FAILURE <I2C device name>	Error	<p>Read access has failed to an internal device on an I2C hardware bus.</p> <p>Certain I2C devices are considered critical and will result in a failure of the array controller while others may result in some loss of functionality (such as lost display messages).</p>	<p>Replace the device.</p> <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
31 I2C WRITE FAILURE <I2C device name>	Error	Read access has failed to an internal device on an I2C hardware bus. Certain I2C devices are considered critical and will result in a failure of the array controller while others may result in some loss of functionality (such as lost display messages).	Replace the device. If this action does not solve the problem, contact HP support.
32 CHASSIS NVRAM CONTENTS CORRUPTED	Error	NVRAM is corrupt. The system cannot continue to operate.	Contact HP support.
40 BEGIN REDUNDANCY SUPPORT	Informational	The array controllers are attempting to enter redundant mode.	—
41 REDUNDANCY ACTIVE ACTIVE CONTROLLER	Informational	The array controllers are now in redundant mode and this array controller is active with enabled access to the configured volumes on the MSA500 system.	—
42 REDUNDANCY ACTIVE STANDBY CONTROLLER	Informational	The array controllers are now in redundant mode and this array controller is in standby , available to be made active if the current active array controller fails, assuming proper cabling and installation.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
43 REDUNDANCY FAILED HARDWARE FAILURE	Error	While either attempting to enter redundant mode or already operating in redundant mode, one of the array controllers encountered a hardware failure on the communication channel between the two array controllers. Redundancy is disabled at this time.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none"> 1. Remove the standby array controller. 2. Wait 10 seconds. 3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not resolve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Remove both array controllers. 3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not resolve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
44 REDUNDANCY FAILED MISMATCH HARDWARE	Error	Both array controllers must contain the same hardware for them to successfully enter redundant mode. The current array controllers do not contain the same hardware, possibly because one has an attached fibre daughter card and the other does not.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none">1. Remove the standby array controller.2. Add or replace the fibre daughter card as needed.3. Wait 10 seconds.4. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none">1. Power down the MSA500 system.2. Remove both array controllers.3. Add or remove fibre daughter cards as need on both controllers.4. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
45 REDUNDANCY FAILED MISMATCH FIRMWARE	Error	Controller Firmware Auto Cloning has failed. Both array controllers must be running the same version of firmware for redundant mode.	Manually update the firmware on the older array controller.
46 REDUNDANCY HALTED EXPAND ACTIVE	Informational	If volume expansion is in progress, redundancy is not supported. ACU initiates and tracks volume expansion. After volume expansion is complete, the system automatically re-establishes redundancy.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
47 REDUNDANCY FAILED CACHE SIZE MISMATCH	Error	Both array controllers must have the same size of cache memory for redundant mode.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none">1. Remove the standby array controller.2. Add or remove cache memory as needed.3. Wait 10 seconds.4. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none">1. Power down the MSA500 system.2. Remove both array controllers.3. Add or remove cache memory as need on both controllers.4. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
48 REDUNDANCY HALTED FIRMWARE CLONED	Informational	Both array controllers must be running the same version of firmware for redundant mode. Controller Firmware Auto Cloning is complete. The system is automatically restarting the standby array controller to attempt redundant mode again.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
49 REDUNDANCY FAILED FIRMWARE LOCKUP	Error	While either attempting to enter redundant mode or already operating in redundant mode, one of the array controllers encountered a critical condition resulting in a firmware lockup. Redundancy is disabled at this time.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none">1. Remove the standby array controller.2. Wait 10 seconds.3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none">1. Power down the MSA500 system.2. Remove both array controllers.3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
50 REDUNDANCY FAILED OUT OF MEMORY	Error	While either attempting to enter redundant mode or already operating in redundant mode, one of the array controllers failed to allocate required memory. Redundancy is disabled at this time.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none"> 1. Remove the standby array controller. 2. Wait 10 seconds. 3. Reinsert the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Remove both array controllers. 3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
51 REDUNDANCY FAILED I/O REQUEST ERROR	Error	While either attempting to enter redundant mode or already operating in redundant mode, one of the array controllers encountered an error while sending I/O between the two array controllers over the communication channel between them. Redundancy is disabled at this time.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none">1. Remove the standby array controller.2. Wait 10 seconds.3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none">1. Power down the MSA500 system.2. Remove both array controllers.3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
52 REDUNDANCY FAILED PCI BUS ERROR	Error	While either attempting to enter redundant mode or already operating in redundant mode, one of the array controllers encountered a PCI bus error on the communication channel used between the two array controllers. Redundancy is disabled at this time.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none"> 1. Remove the standby array controller. 2. Wait 10 seconds. 3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Remove both array controllers. 3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>
53 REDUNDANCY FAILED NO SECOND CONTROLLER	Error	While operating in redundant mode, one of the array controllers was removed. Redundancy is disabled at this time.	Reinstall the missing array controller, and be sure that it seats fully in the chassis.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
54 REDUNDANCY FAILED CACHE DIMMS MISMATCH	Error	The cache memory modules on two different controllers are not the same size. All cache memory modules must be the same size for redundant mode.	<ol style="list-style-type: none">1. Remove the array controller that has halted.2. Replace the cache memory with the appropriately sized DIMMs.3. Wait 10 seconds.4. Reinstall the array controller, and be sure that it seats fully in the chassis.
60 NO CACHE MODULE FOUND	Error	The array controller requires at least one cache module in order to operate. The cache module is not present or it has failed.	<ol style="list-style-type: none">1. Remove the failed array controller.2. Either add a cache module or replace the failed one.3. Wait 10 seconds.4. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
61 DUAL CACHE MODULE SIZE MISMATCH	Error	The array controller has two cache modules attached, but they are of different sizes. Both cache modules must be the same size.	<ol style="list-style-type: none"> 1. Remove the failed array controller. 2. Replace one of the cache modules with a different module with the correct memory. 3. Wait 10 seconds. 4. Reinstall the array controller, and be sure that it seats fully in the chassis.
62 CACHE MODULE #<n> <n>MB	Informational	Displays the size of the cache module inserted into the respective cache module slot.	—
63 VALID CACHE DATA FOUND AT POWER-UP	Informational	Valid host data exists in the battery-backed cache memory at power up. The controller has flushed this data to the drives.	—
64 CACHE DATA LOST BATTERY DEAD	Error	The battery on the cache memory is no longer charged. If data existed in the cache memory, it is lost.	—
65 CACHE HARDWARE ENABLED	Informational	The cache hardware was temporarily disabled, but it is enabled again. This message might result from insufficient charge on the batteries that are now charged to capacity.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
66 CACHE HARDWARE FAILED AND DISABLED	Error	The cache memory has experienced a hardware failure.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none"> 1. Remove the standby array controller. 2. Wait 10 seconds. 3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Remove both array controllers. 3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
67 CACHE HARDWARE TEMPORARILY DISABLED	Informational	The cache memory hardware is temporarily disabled, typically because either the battery is not charged or a capacity expansion operation is occurring. After the problem is solved, the system automatically enables the cache.	<p>If a capacity expansion operation is occurring, wait for the process to finish.</p> <p>If the battery is not charged, allow sufficient time for the battery to charge or replace the cache module.</p> <p>If this action does not solve the problem, contact HP support.</p>
68 OBSOLETE CACHE DATA DELETED	Informational	Old data that no longer belongs to any current configured volumes exists in the cache memory at power up. The controller deleted this data. This action typically results when cache modules are migrated between array controllers.	—
69 CACHE BATTERIES LOW, RECHARGING	Informational	The batteries on the cache module are low; the system is recharging batteries.	—
70 CACHE DISABLED NO CONFIGURATION	Informational	The controller has disabled the cache because the cache is unconfigured.	Use ACU to configure the cache.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
71 SYSTEM HALTED FOR CACHE ERROR	Error	<p>The user has chosen to address a critical cache error condition.</p> <p>Message 72 always precedes message 71 (although message 72 is removed from the LCD display after it has accepted user input).</p>	<p>Select the NO option to halt the controller and solve the problem.</p> <p>Select the YES option to erase the cache data. Operation of the array controller will continue normally.</p> <p>Error 1.1 and 1.2: Only one cache board is in the array controller, but the controller was configured with a second cache board that is missing (dual cache module configuration).</p> <p>Error 2.1 and 2.2: A second cache board that contained valid data was removed from its original array controller and added to this array controller (dual cache module configuration).</p> <p>Error 2.3: A cache board that contained valid data was removed from its original array controller and added to this array controller (single cache module configuration).</p> <ol style="list-style-type: none">1. Return all cache boards to their original array controllers.2. Power up the systems without allowing any host I/O.3. Wait for the controller to write cache data to the drives. This can take several minutes.4. Power down the systems and relocate cache boards as needed. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
72 CACHE ERROR <n> IGNORE? <=NO >=YES	User Input	<p>During power up, the controller found data in the cache but could not flush the data to the drives.</p> <p>One of two conditions exist:</p> <ul style="list-style-type: none"> The data does not belong to this array controller (the cache board was moved from a different array controller). The cache data is partial or incomplete (the rest of the data is in another cache board that was removed from the array controller). <p>This error can occur if cache boards are moved improperly.</p>	<p>Select the NO option to halt the controller and solve the problem.</p> <p>Select the YES option to erase the cache data. Operation of the array controller will continue normally.</p> <p>Error 1.1 and 1.2: Only one cache board is in the array controller, but the controller was configured with a second cache board that is missing (dual cache module configuration).</p> <p>Error 2.1 and 2.2: A second cache board that contained valid data was removed from its original array controller and added to this array controller (dual cache module configuration).</p> <p>Error 2.3: A cache board that contained valid data was removed from its original array controller and added to this array controller (single cache module configuration).</p> <ol style="list-style-type: none"> Return all cache boards to their original array controllers. Power up the systems without allowing any host I/O. Wait for the controller to write cache data to the drives. This can take several minutes. Power down the systems and relocate cache boards as needed. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
73 CACHE HARDWARE BATTERIES MISSING	Error	The cache memory batteries are missing.	<p>If the MSA500 system is currently involved in host I/O:</p> <ol style="list-style-type: none">1. Remove the standby array controller.2. Wait 10 seconds.3. Reinstall the controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, wait until downtime is available and do the following:</p> <ol style="list-style-type: none">1. Power down the MSA500 system.2. Remove both array controllers.3. Reinstall both array controllers, and be sure that they seat fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>
80 REPLACEMENT DRIVE FOUND BOX #<n> BAY <n>	Informational	A SCSI drive that was previously missing or failed has been replaced with a working SCSI drive.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
81 SMART DRIVE ALERT BOX #<n>, BAY <n>	Informational	A SCSI drive may be close to failing. The prefailure condition was determined either by the drive firmware using SMART technology or by the array controller using monitor and performance testing.	Replace the drive as soon as possible. Refer to “Recovering from Hard Drive Failure” in Appendix D.
82 DRIVE HOT ADDED BOX #<n>, BAY <n>	Informational	A SCSI drive has been added to the MSA500 system or to one of the storage enclosures attached to it.	—
83 DRIVE HOT REMOVED BOX #<n>, BAY <n>	Informational	A SCSI drive has been removed from the MSA500 system or from one of the storage enclosures attached to it.	—
84 DRIVE FAILURE BOX #<n>, BAY <n>	Error	A SCSI drive in the MSA500 system or in one of the storage enclosures attached to it has failed. If the drive was part of a configured volume, the state of the volume depends on the fault tolerance used.	Replace the drive as soon as possible. Refer to “Recovering from Hard Drive Failure” in Appendix D.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
85 BAD DRIVE FRMWARE BOX #<n>, BAY <n>	Error	A SCSI drive has corrupt firmware. Continued use of this drive could result in drive failure, decreased performance, or data loss.	<p>Do one of the following:</p> <ul style="list-style-type: none">• Update the drive firmware. Refer to Chapter 3, “Hardware Options Installation.”• Replace the drive as soon as possible. Refer to “Recovering from Hard Drive Failure” in Appendix D. <p>If this action does not solve the problem, contact HP support.</p>
86 DRIVE POSITION CHANGE DETECTED	Informational	<p>The physical drive locations have changed for SCSI drives that constitute a configured volume within the MSA500 system or an attached storage enclosure.</p> <p>The array controller has updated its configuration information accordingly.</p>	—
87 DRIVE POSITION CHANGE INVALID	Informational	<p>The physical drive locations have changed for SCSI drives that constitute a configured volume within the MSA500 system or an attached storage enclosure.</p> <p>The array controller can no longer access the configured volume.</p>	<ol style="list-style-type: none">1. Power down the MSA500 system.2. Restore the drives to their original positions. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
89 INVALID VOLUME ADDITION	Error	The array controller has detected an illegal volume addition.	Remove the added volume.
90 RIS VERSION EXCEEDED	Error	The array controller has detected a version of the RIS that it does not support.	Remove the volumes that were added.
100 VOLUME #<n> STATE OK	Informational	The configured volume has returned to its normal operating state. This condition typically occurs after a rebuild operation is complete.	—
101 VOLUME #<n> STATE FAILED	Error	The controller failed the configured volume because too many physical drives have failed, exceeding the fault tolerance level. The data on the configured volume is no longer available.	—
102 VOLUME #<n> STATE INTERIM RECOVERY	Informational	<p>The array controller failed one or more physical drives that constitute the configured volume.</p> <p>No data loss has occurred because fault tolerance is allowing data recovery.</p>	Replace the failed drives as soon as possible. Refer to “Recovering from Hard Drive Failure” in Appendix D.
103 VOLUME #<n> STATE REBUILDING	Informational	The configured volume is rebuilding data on a physical drive that replaced a previously failed drive.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
104 VOLUME #<n> STATE DISABLED	Error	The controller disabled the configured volume because too many of the physical drives that constitute the volume are missing.	<ol style="list-style-type: none">1. Power down the MSA500 system.2. Power down all attached storage enclosures.3. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays.4. Check for proper connections on the cables between the MSA500 system and any attached storage enclosures.5. Power up the attached storage enclosures.6. Power up the MSA500 system. <p>If this action does not solve the problem, contact HP support.</p>
105 VOLUME #<n> STATE EXPANSION ACTIVE	Informational	The configured volume is performing a volume expansion operation.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
106 VOLUME #<n> STATE WAITING TO REBUILD	Informational	<p>The configured volume is waiting before rebuilding data on a physical drive that replaces a previously failed drive.</p> <p>The rebuild may not have started yet because the array controller is already performing a rebuild on another configured volume.</p>	—
107 VOLUME #<n> STATE WAITING TO EXPAND	Informational	<p>The configured volume is waiting to start a volume expansion operation.</p> <p>The expansion may have not started yet because another configured volume is undergoing expansion or a rebuild is occurring on the configured volume.</p>	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
108 VOLUME #<n> STATE MISSING DRIVES	Error	The configured volume is unusable because it is missing too many of the physical drives that constitute the volume. The controller will disable this volume.	<ol style="list-style-type: none">1. Power down the MSA500 system.2. Power down all attached storage enclosures.3. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays.4. Check for proper connections on the cables between the MSA500 system and any attached storage enclosures.5. Power up the attached storage enclosures.6. Power up the MSA500 system. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
109 VOLUME #<n> STATE WRONG DRIVE REPLACED	Error	The controller recognizes drive replacement on working physical drives rather than failed drives.	<ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Reinstall the working drives. 3. Replace the failed drives. 4. Power up the MSA500 system.
110 VOLUME #<n> EXPANSION DISABLED	Informational	<p>The controller disabled volume expansion operation on the configured volume. This condition can result from the following:</p> <ul style="list-style-type: none"> • An ongoing rebuild operation • Another expansion operation • Disabled cache memory caused by a low battery <p>The expansion resumes after the condition has been cleared.</p>	<p>Wait for the current operation to finish.</p> <p>If the condition does not change, replace the cache module.</p>
111 VOLUME #<n> INITIALIZING PARITY	Informational	The array controller is calculating and storing parity information for the configured volume and performance may be lower until this operation is complete.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
112 VOLUME #<n> REBUILD FAILURE	Error	The rebuild operation on the configured volume failed.	If the volume is still operating in regenerative mode, remove the replacement drive and replace it with a different new drive.
113 VOLUME #<n> EXPANSION FAILURE	Error	The volume expansion operation on the configured volume failed.	Run ACU and determine the state of the volume. If the volume is still operational, reattempt the operation.
114 VOLUME #<n> STATE DELETED	Informational	The configured volume is deleted and no longer available. Use ACU to delete volumes.	—
120 CONFIGURED VOLUMES <n>	Informational	The controller detected the specified number of configured volumes at power up.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
121 NO VOLUMES DETECTED	Informational	The controller did not detect configured volumes at power up.	<p>If configured volumes are expected at power up:</p> <ol style="list-style-type: none"> 1. Power down the MSA500 system. 2. Power down all attached storage enclosures. 3. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays. 4. Check for proper connections on the cables between the MSA500 system and any attached storage enclosures. 5. Power up the attached storage enclosures. 6. Power up the MSA500 system. <p>If this action does not solve the problem, contact HP support.</p>
122 NEW VOLUME(S) DETECTED	Informational	Configured volumes from another array controller were migrated to this array controller. The controller updated the configuration information.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
123 TOO MANY VOLUMES DETECTED	Error	<p>The controller detected more than 32 volumes (maximum supported) at power up.</p> <p>This condition can occur when the ACU migrates a set of volumes from one array controller to a different array controller that already contains configured volumes.</p> <p>The controller does not add the migrated volumes.</p>	<ol style="list-style-type: none">1. Remove the migrated drives.2. Run ACU.3. Delete any unneeded volumes until the number of existing volumes plus the number of volumes awaiting migration is equal to or less than 32 volumes.4. Add the migrated volumes. <p>If this action does not solve the problem, contact HP support.</p>
124 SPARES CLEARED	Informational	<p>A set of volumes have been migrated from one array controller to a different array controller that already contains configured volumes. The migrated volumes have spares defined for them that conflict with the existing configuration. The defined spares have been deleted to allow the migration to proceed.</p>	Run ACU to reassign spare drives as needed.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
125 ACCESS CONTROL CONFLICT DETECTED	Error	A set of volumes have been migrated from one array controller to a different array controller that already contains configured volumes. The migrated volumes have access controls defined for them that conflict with the existing configuration. The access controls have been modified to allow the migration to proceed.	Run ACU to check the new access controls and modify them if needed.
126 ACCESS CONTROL RESOURCES EXCEEDED	Error	A set of volumes have been migrated from one array controller to a different array controller that already has configured volumes on it. The migrated volumes have access controls defined for them that conflict with the existing configuration. The access controls have been modified so as to allow the migration to proceed.	Run ACU to check the new access controls and modify them if needed.
201 ARRAY CONTROLLER TEMPERATURE OK	Informational	The controller temperature is within the normal operating range. Message 201 follows messages 202 and 203 when the temperature problem no longer exists.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
202 ARRAY CONTROLLER OVERHEATING	Error	The temperature sensor on the array controller indicates that the array controller is exceeding the normal operating range.	<ol style="list-style-type: none"> 1. Be sure that all MSA500 system fans are operating. 2. Replace any failed fans. 3. Be sure that all bays are populated with components or blanks. <p>If this action does not solve the problem, contact HP support.</p>
203 ARRAY CONTROLLER OVERHEATED	Error	The temperature sensor on the array controller indicates that the array controller exceeded the safe operating range.	<ol style="list-style-type: none"> 1. Power down the MSA500 system as soon as possible to avoid hardware failure. 2. Be sure that all MSA500 system fans are operating. 3. Replace any failed fans. 4. Be sure that all bays are populated with components or blanks. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
204 ARRAY CONTROLLER DISABLED	Error	The array controller is disabled because of a redundancy failure.	<ol style="list-style-type: none"> 1. Remove the failed array controller. 2. Wait 10 seconds. 3. Reinstall the array controller, and be sure that it seats fully. <p>If this action does not solve the problem, contact HP support.</p>
205 ARRAY CONTROLLER RESTARTING	Informational	The array controller has completed Controller Firmware Auto Cloning and is restarting automatically.	—
300 RECOVERY ROM AUTOFLASH STARTED	Informational	Indicates that the array controller detected that the firmware's backup recovery ROM image is invalid and is copying the current active firmware image into the backup recovery ROM.	—
301 RECOVERY ROM AUTOFLASH DONE	Informational	Indicates that the array controller successfully completed the process of copying the current active firmware image into the backup recovery ROM.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
302 RECOVERY ROM AUTOFLASH FAILED	Error	Indicates that the array controller failed to copy the current active firmware image into the backup recovery ROM. Recovery ROM support is disabled.	<ol style="list-style-type: none">1. Remove the failing array controller.2. Wait 10 seconds.3. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>The controller reattempts the ROM autoflash process again.</p> <p>If this action does not solve the problem, contact HP support.</p>
303 ROM CLONING STARTED	Informational	Indicates that the two array controllers in a MSA500 system do not have the same version of firmware. Controller firmware auto cloning begins.	Refer to Chapter 4, "Configuration and Utilities."
304 ROM CLONING DONE	Informational	Indicates that the two array controllers in a MSA500 system completed the firmware cloning process.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
305 ROM CLONING FAILED	Error	Indicates that the two array controllers in a MSA500 system failed the firmware cloning process.	<ol style="list-style-type: none"> 1. Remove the failing array controller. 2. Wait 10 seconds. 3. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>The controller reattempts the controller firmware auto cloning process again.</p> <p>If this action does not solve the problem, contact HP support.</p>
306 FIRMWARE FLASH STARTED	Informational	Indicates that the array controller in the MSA500 system is flashing the firmware.	<p>Do not power down the system until the process is complete.</p> <p>The process could take up to 5 minutes.</p>
307 FIRMWARE FLASH DONE	Informational	Indicates that the array controller in the MSA500 system completed the firmware flash process.	Power down the system.
308 FIRMWARE FLASH FAILED	Error	Indicates that the array controller in the MSA500 system failed the firmware flash process.	<p>Attempt the flash process again.</p> <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
309 EMU FLASH STARTED	Informational	Indicates that the I/O EMU in the MSA500 system is flashing the firmware.	Do not power down the system until the process is complete. The process could take up to 5 minutes. If this action does not solve the problem, contact HP support.
310 EMU FLASH DONE	Informational	Indicates that the I/O EMU in a MSA500 system completed the firmware flash process.	Power down the system.
311 EMU FLASH FAILED	Error	Indicates that the I/O EMU in a MSA500 system has failed the firmware flash process.	Attempt the flash process again. If this action does not solve the problem, contact HP support.
400 STORAGE BOX #<n> FAN OK	Informational	The specified storage enclosure indicates that one of its previously failed or degraded fans is now operating normally.	—
401 STORAGE BOX #<n> FAN FAILED	Error	The specified storage enclosure indicates that one of its fans has failed. The storage enclosure and any devices in it may now be susceptible to overheating if corrective action is not taken.	<ol style="list-style-type: none">1. Be sure that all MSA500 system fans are operating.2. Replace any failed fans. If this action does not solve the problem, contact HP support.

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
402 STORAGE BOX #<n> FAN DEGRADED	Error	The specified storage enclosure indicates that one of its fans is not operating at full efficiency. The fan may eventually fail.	<ol style="list-style-type: none"> 1. Be sure that all MSA500 system fans are operating. 2. Replace any failed fans. <p>If this action does not solve the problem, contact HP support.</p>
403 STORAGE BOX #<n> FAN HOT INSERTED	Informational	The specified storage enclosure indicates that a fan was added.	—
404 STORAGE BOX #<n> FAN HOT REMOVED	Informational	The specified storage enclosure indicates that a fan was removed.	—
405 STORAGE BOX #<n> TEMPERATURE OK	Informational	The temperature sensor in the storage enclosure indicates that the temperature is in the normal operating range.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
406 STORAGE BOX #<n> OVERHEATING	Error	The temperature sensor in the storage enclosure indicates that the enclosure is exceeding the normal operating range.	<ol style="list-style-type: none"> 1. Power down the MSA500 system as soon as possible to avoid hardware failure. 2. Be sure that all MSA500 system fans are operating. 3. Replace any failed fans. 4. Be sure that all bays are populated with components or blanks. <p>If this action does not solve the problem, contact HP support.</p>
407 STORAGE BOX #<n> OVERHEATED	Error	The temperature sensor in the storage enclosure indicates that the enclosure exceeded the safe operating range.	<ol style="list-style-type: none"> 1. Power down the MSA500 system as soon as possible to avoid hardware failure. 2. Be sure that all MSA500 system fans are operating. 3. Replace any failed fans. 4. Be sure that all bays are populated with components or blanks. <p>If this action does not solve the problem, contact HP support.</p>

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
408 STORAGE BOX #<n> POWER SUPPLY OK	Informational	The specified storage enclosure indicates that one of its previously failed power supplies is now operating normally.	—
409 STORAGE BOX #<n> POWER SUPPLY FAILED	Error	The specified storage enclosure indicates that one of its power supplies failed.	<ol style="list-style-type: none"> 1. Check all power supplies for damage. 2. Replace any failed power supplies. <p>If this action does not solve the problem, contact HP support.</p>
410 STORAGE BOX #<n> POWER SUPPLY ADDED	Informational	The specified storage enclosure indicates that a power supply was added.	—
411 STORAGE BOX #<n> POWER SUPPLY REMOVED	Informational	The specified storage enclosure indicates that a power supply was removed.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
412 STORAGE BOX #<n> EMU NOT RESPONDING	Error	The specified storage enclosure is not responding to commands.	<ol style="list-style-type: none">1. Be sure that the storage box is powered up.2. Be sure that all cables are connected securely.3. Power down the MSA500 system.4. Power down the storage box.5. Power up the storage box.6. Power up the MSA500 system. <p>If this action does not solve the problem, contact HP support.</p>
413 STORAGE BOX #<n> EMU VERSION <version>	Informational	Displays the version of the firmware running on the I/O EMU. This display only applies the internal I/O EMU of the MSA500 system. The controller does not display versions for externally connected storage boxes.	—
500 INITIALIZING PCI SUBSYSTEM	Informational	The array controller PCI subsystem is initializing as part of the power up sequence.	—

continued

Table C-1: Display Messages *continued*

Message	Type	Description	Action
501 PCI SUBSYSTEM HARDWARE FAILURE	Error	The array controller PCI subsystem encountered a critical error during the power up sequence.	<ol style="list-style-type: none"> 1. Remove the failed array controller. 2. Wait 10 seconds. 3. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>
502 PCI BRIDGE ASIC SELF TEST FAILURE	Error	The array controller PCI bridge ASIC has encountered a critical error during the power up sequence.	<ol style="list-style-type: none"> 1. Remove the failed array controller. 2. Wait 10 seconds. 3. Reinstall the array controller, and be sure that it seats fully in the chassis. <p>If this action does not solve the problem, contact HP support.</p>
513 UNCORRECTED ECC MEMORY ERROR SEEN	Error	The array controller has detected an uncorrectable error in the ECC memory on the memory cache board.	Remove the failed array controller and replace the cache module DIMM.
518 <name> CONNECTION LOST	Error	The named connection has been lost.	<p>Check SCSI connections to the server.</p> <p>Also, the controller may have a failed SCSI controller chip.</p>
519 <name> CONNECTION RESTORED	Informational	The named connection has been restored.	—

Troubleshooting

This appendix provides specific troubleshooting information for the HP MSA500 system. Use it to find details about startup and operation errors.

For a list of error messages specific to this system, refer to Appendix C, “Display Messages.” For information on LEDs, refer to Chapter 1, “Component Identification.”

This appendix includes the following topics:

- When the System Does Not Start

You are provided with initial instructions on what to try and where to go for help for the most common problems encountered during initial POST. A successful startup requires the system to power up and provide the “Startup Complete” message.

- Diagnosis Steps

If the system does not power up after you have performed initial troubleshooting procedures, use the tables in this section to identify possible reasons for the problem, possible solutions, and references to other sources of information.

- Recovering from Hard Drive Failure

Fault tolerance provides protection from data loss during drive failures, but specific procedures for recovery are necessary. Use the procedures in this section to optimize the recovery effort.

When the System Does Not Start



WARNING: A risk of personal injury exists from hazardous energy levels. The installation of options and the routine maintenance and service of this product must be performed by individuals who are knowledgeable about the procedures, precautions, and hazards associated with equipment containing hazardous energy circuits.

If the system does not start:

1. Be sure that the attached server and monitor are working properly.
2. Be sure that the system is plugged into working outlets.
3. Be sure that the power source is working properly:
 - a. Check the status using the system power LED. For the location and explanation of the system power LED, refer to Chapter 1, “Component Identification.”
 - b. Be sure that the Power On/Standby button was pressed firmly.
4. Be sure that the power supplies are working properly.

Check the status using the power supply/blower assembly LEDs. For the location and explanation of these LEDs, refer to “Rear Panel LEDs” in Chapter 1, “Component Identification.”

5. Restart the system. Refer to “System Power Down” in Chapter 2, “Installation and Operation.”

IMPORTANT: If the system does not restart, proceed to “Diagnostic Steps” in this appendix.

6. Check the system for the following normal power-up sequence to be sure that the system meets the minimal hardware requirements and is powered up during normal operations:
 - a. The front panel system power LED turns from off (standby/off) to solid green (on).
 - b. The blowers start up.
 - c. The 2-Port or 4-Port Shared Storage Module LED flashes green.

7. The controller display provides a “Startup Complete” message.

Diagnostic Steps

If the storage system does not power up, or powers up but does not complete POST, answer the questions in Table D-1 to determine the appropriate actions. The flow of questions reflects the usual flow of events during a power-up sequence.

According to the answers you give, you are directed to the appropriate table in this section. That table outlines possible reasons for the problem, options available to assist in diagnosis, possible solutions, and references to other sources of information.

Table D-1: Diagnostic Steps

Question	Action
Question 1: Are the power supply/blower assembly LEDs green?	If yes, continue to question 2. If no, refer to Table D-2.
Question 2: Is the system power LED green?	If yes, continue to question 3. If no, refer to Table D-3.
Question 3: Is the controller display providing messages?	If yes, use the messages for further diagnosis. See Table D-4 for details. If no, refer to Table D-4.

Table D-2: Are the Power Supply/Blower Assembly LEDs Green?

Answer	Possible Reasons	Possible Solutions
No	<p>The power cords are not connected or AC power is not available.</p> <p>A power supply problem exists. The power supply may not be inserted properly, it may have a damaged connector, or it may have failed.</p> <p>The system backplane is damaged and may need to be replaced.</p>	<p>Be sure that the power cord is connected to the power supply.</p> <p>Be sure that the power supply is undamaged and that the power supply is fully seated.</p> <p>Be sure that the connectors on the system backplane are undamaged.</p> <p>Check for bent pins on connectors and components.</p> <p>If these solutions do not solve the problem, contact an HP authorized service provider for assistance.</p>
Yes	<p>If the system power LED is off, do the following:</p> <ol style="list-style-type: none"> 1. Press the Power On/Standby button. 2. Refer to Table D-3. 	
Note: For LED locations and functions, refer to Chapter 1, "Component Identification."		

Table D-3: Is the System Power LED Green?

Answer	Possible Reasons	Possible Solutions
No	<p>The Power On/Standby button has not been pressed firmly.</p> <p>The power button/LED assembly has failed.</p> <p>A power supply problem exists. The power supply may not be inserted properly, it may have a damaged connector, or it may have failed.</p> <p>The system may have experienced a short.</p> <p>Controller firmware may be corrupted.</p> <p>The system backplane may need to be replaced.</p>	<p>Firmly press the power button.</p> <p>Be sure that the power supply is undamaged and securely seated.</p> <p>Check for bent pins on connectors and components.</p> <p>Check for unseated components.</p> <p>Flash the controller firmware. Refer to Chapter 4, “Configuration and Utilities.”</p> <p>If these solutions do not solve the problem, contact an HP authorized service provider for assistance.</p>
Yes	If the system power LED is green, refer to Table D-4.	
Note: For LED locations and functions, refer to Chapter 1, “Component Identification.”		

Table D-4: Is the Controller Display Providing Messages?

Answer	Possible Reasons	Possible Solutions
No	A controller problem exists. The controller may not be inserted properly, it may have a damaged connector, or it may have failed and is in need of replacement.	<p>Be sure that the controller is undamaged and securely seated.</p> <p>Check for bent pins on connectors and components.</p> <p>When the controller display is working properly, refer to the Yes response below.</p>
Yes	Display messages are available for diagnosis. Determine the next action by observing the messages. Refer to Appendix C, "Display Messages."	

Recovering from Hard Drive Failure



CAUTION: Back up all data before removing drives or changing configurations. Failure to do so could result in permanent loss of data. Before moving drives and arrays, run ACU 6.0.

The purpose of fault-tolerant configurations on the HP MSA500 controller is to protect against data loss due to drive failure. Although the MSA500 controller firmware is designed to protect against normal drive failure, you must perform the correct actions to recover from a drive failure without inadvertently inducing any additional drive failures. Multiple drive failures in the same array generally result in data loss (exceptions include failures following activation of a spare drive, and failure of drives in a mirroring configuration that are not mirrored to one another or ADG configuration).

Drives may be either Ultra2 or Ultra 3 hot-plug universal hard disk drives. When grouping drives in an array, always use drives of the same capacity. The array cannot use the excess capacity of a larger drive, so this capacity is ignored and wasted.

A list of supported hard drives is available at the HP website

www.hp.com/products/sharedstorage

Hard Drive Failure

When a hard drive fails, all logical drives in the same array are affected. Each logical drive in an array may be using a different fault tolerance method, so the effect on each logical drive can be different.

- RAID 0 configurations cannot tolerate drive failure. If any physical drive in the array fails, the controller fails all non-fault-tolerant (RAID 0) logical drives in the same array.
- RAID 1 configurations can tolerate multiple drive failures as long as no failed drives are mirrored to one another.
- RAID 5 configurations can tolerate one drive failure.
- RAID ADG configurations can tolerate simultaneous failure of two drives in the array.

- Spare hard drive configuration guidelines include:
 - Always assign a spare to each individual array separately.
 - Always be sure that the capacity of the spare is greater than or equal to the capacity of any drive that it is intended to replace.
 - Always be sure that a spare assigned to multiple controllers is of greater or equal capacity to any drives in that array.

NOTE: Only remove hard drives that have been failed or marked as degraded by the controller.

If more hard drives are failed than the fault-tolerance method allows, fault tolerance is “compromised” and the logical drive is failed. In this case, all requests from the operating system are rejected with “unrecoverable” errors. The section on Compromised Fault Tolerance later in this appendix discusses possible ways to recover from this situation.

Recognizing Drive Failure

The LEDs on the front of each hard drive are visible through the front of the external storage unit. When a drive is configured as a part of an array and attached to a powered up controller, the status of the drive can be determined from the illumination pattern of these LEDs. For drive status information, refer to Chapter 1, “Component Identification.”

Other ways to recognize that a hard drive has failed include:

- The amber LED illuminates on the front of an HP storage system if installed drives fail. (The LED also illuminates amber for fan failure, redundant power supply failure, or overtemperature conditions.)
- A controller display message will list failed drives whenever the system is restarted, as long as the controller detects one or more good drives.
- Insight Manager 7 can detect failed drives locally or remotely across a network.

Additional information on troubleshooting hard drive problems can be found in the *HP ProLiant Servers Troubleshooting Guide*.

Compromised Fault Tolerance

Compromised fault tolerance commonly occurs when more physical drives have failed than the fault tolerance method can endure. In this case, the controller fails the logical volume and returns “unrecoverable disk” error messages to the host. Data loss is likely to occur.

An example of this situation would be a RAID 5 logical drive, where one drive on an array fails while the controller is rebuilding another drive in the same array.

Fault tolerance may also be compromised because of non-drive problems, such as a faulty cable, faulty storage system power supply, or a user accidentally turning off an external storage system while the host system power was on. In such cases, the physical drive replacement is not needed. However, data loss may have occurred, especially if the system was busy at the time the problem happened.

IMPORTANT: To minimize the risk of data loss from compromised fault tolerance, make frequent backups of all logical volumes.

Procedure to Attempt Recovery

Inserting replacement drives when fault tolerance has been compromised does not improve the condition of the logical volume. Instead, if unrecoverable error messages display on the screen, try the following procedure to recover data.

1. Check for loose, dirty, broken, or bent cabling and connectors on all devices.
2. Power down and remove power from the entire system. Remove and then reinsert all hard drives and controllers.



CAUTION: Data can be lost if the drives are not firmly reseated.

3. Power up the system. In some cases, a marginal drive might work again for a sufficient period enabling you to make copies of important files.
4. If the #02 or #04 controller display message is displayed, press the right button to re-enable the logical volumes. Remember that data loss has probably occurred and any data on the logical volume is suspect.
5. Make copies of important data, if possible.

6. Replace any failed drives.
7. After the failed drives have been replaced, the fault tolerance may again be compromised. If so, cycle the power again, and if the #02 or #04 controller display message is displayed, press the right push button. This action re-enables the logical drive(s).

Automatic Data Recovery

Automatic Data Recovery is an automatic background process that rebuilds data onto a spare or replacement drive when another drive in the array fails. The hard drive that is being rebuilt flashes once per second.

If a drive in a fault-tolerant configuration is replaced while the system power is off, a controller display message appears during the next system startup. Automatic Data Recovery starts.

When Automatic Data Recovery is completed, the online LED of the replacement drive stops flashing and illuminates steadily.

In general, the system requires approximately 15 minutes to rebuild each gigabyte. The actual rebuild time depends upon the following:

- The rebuild priority level (high or low) of the logical drive
- The amount of I/O activity occurring during the rebuild operation
- The disk drive speed
- The number of drives in the array (for RAID 5 and RAID ADG)

For example, the rebuild time for 9-GB Wide-Ultra hard drives in a RAID 5 configuration varies from 10 minutes per gigabyte (for three drives) to 20 minutes per gigabyte (for 14 drives).

Failure of Automatic Data Recovery

If the online LED of the replacement drive stops flashing during Automatic Data Recovery, two possible causes are:

- The replacement drive is failed (amber failure LED illuminated or other LEDs not illuminated) and is producing unrecoverable disk errors. Remove and replace the failed replacement drive.
- The Automatic Data Recovery process may have abnormally terminated, because of a non-correctable read error (such as a SCSI bus signal integrity problem) from another physical drive during the recovery process.

Reboot the system and retry Automatic Data Recovery. If this does not work, backup all data on the system, do a surface analysis (using User Diagnostics), and restore the data from backup.

Replacing a Drive

Replacement drives must have a capacity no less than that of the smallest drive in the array. The controller immediately fails drives with insufficient capacity before Automatic Data Recovery can begin.



CAUTION: Sometimes, a drive that has previously been failed by the controller may seem to be operational after the system power is cycled, or (for a hot-plug drive) after the drive has been removed and reinserted. However, continued use of such marginal drives may eventually result in data loss. Replace the marginal drive as soon as possible.

A hot-plug drive is available for removal and replacement at any time, regardless of the state of the host or storage system power. Both system performance and fault tolerance are affected until the rebuild operation is completed. A rebuild can take several hours, even if the system is not busy during the rebuild.

During hot-plug drive insertion, all disk activity on the array is paused while the new drive is spinning up (approximately 10 seconds). If the drive is inserted while power is on, in a fault-tolerant configuration, data recovery onto the replacement drive begins automatically (indicated by the flashing online LED).

Always perform disk drive replacement as soon as possible. In addition, all logical volumes on the same array as the drive being replaced should have a current valid backup.

If another drive in the array fails while you are rebuilding a previously failed drive, fault tolerance is compromised and all data on the array is lost, with the following exceptions:

- In a mirrored (RAID 1) configuration, failure of a drive that is not mirrored to any other failed drives.
- A second drive failure in a RAID ADG configuration.

Take these precautions when removing failed drives to minimize the likelihood of compromising the logical drive data:

- Do not remove a degraded drive if any other member of the array is offline (the online LED is off).
- Do not remove a failed second drive from an array until the first failed or missing drive has been replaced **and** the rebuild process is complete. (When the rebuild is complete, the online LED on the front of the drive stops flashing.) Exceptions include RAID ADG configurations, as any two drives in the array can be replaced simultaneously

When a hard drive is replaced, the controller uses fault tolerance data on the remaining drives in the array to rebuild data onto the replacement drive. If more than one drive is removed at a time, the fault tolerance data is incomplete. The missing data cannot then be reconstructed and is likely to be permanently lost.

Drive Failure in NetWare

Although hard drive failures are not common, it is important to protect all critical data. To be sure of a quick and transparent recovery, HP recommends that you configure the array controller using a hardware-based fault tolerance method. These methods are more reliable than software-based fault tolerance methods or drive duplexing.

HP also recommends that you use good backup procedures, in case of catastrophic failure.

If a drive fails and you have hardware fault tolerance enabled, system operations continue. However, you should replace the drive as soon as possible to prevent failure of the array. If you do not replace the failed drive, the only option using CPQONLIN is to delete logical volumes. Do **not** delete logical volumes that contain valid data, or the data will be lost.

To monitor the status of a drive recovery, select the logical drive on the **Main Configuration** screen and press **F3**. The **Logical Drive Information** screen shows the status of the drive.

- **Interim Recovery:** The logical drive is operating, but a failed drive has not been replaced. Replace the drive as soon as possible.
- **Ready for Recovery:** The logical drives are queued for recovery. This status is displayed when another logical drive is already rebuilding or expanding.
- **Rebuilding:** The array is operating and rebuilding a replacement drive or an online spare, if one was assigned.
- **Logical Drive Failed:** If you have one or more logical drives that are not protected by fault tolerance, the data on these logical drives is lost; CPQONLIN shows these logical drives as failed. After hard drive replacement, any fault-tolerant logical drives will rebuild. The logical drives that were not protected (failed) will become available for data (the devices are reactivated automatically). If you have a backup of the data, restore the data now.

The following pages describe recovery procedures for systems that are using hardware-based fault tolerance, software-based (NetWare) fault tolerance, and no fault tolerance.

Hardware-Based Fault Tolerance

1. Identify and document which physical drive has failed. (On hot-plug drives in a ProLiant server or storage system, this is indicated by an amber drive failure LED on the drive tray.) Note the drive type and capacity.

NOTE: Storage systems using hardware-based fault tolerance in NetWare cannot detect failure of a single physical drive. In this case, the data will still show as valid and accessible during the rebuilding process. However, the driver will have registered that a physical drive has failed, and a message will be displayed notifying the user that a logical drive is in a degraded state. CPQONLIN will also show the drive has failed.

2. Note which partition and volume, if any has failed. This information is provided in the error message on the server console. It is also recorded in the server error log file, which can be viewed using the NWADMIN Utility.
3. Remove the failed drive and replace it with a drive that is of the same type and capacity. For hot-plug drives, after you secure the drive in the bay, the LEDs on the drive each flash once in an alternating pattern to indicate that the connection was successful. The online LED flashes, indicating that the controller recognized the drive replacement and began the recovery process.
4. Power up the storage system, if it was turned off in step 3.
5. The array controller firmware rebuilds information that was on the failed hard drive onto the new drive, based on information from the remaining physical drives in the logical drive. While reconstructing the data on hot-plug drives, the online LED flashes. When drive rebuild is complete, the online LED is illuminated.

No Fault Tolerance

If you configured the system for no fault tolerance, data must be recovered from backup media. Perform the following steps:

1. Record the device number and device name of the failed logical drive. This information is shown on the server console and recorded in the server error log file, which may be viewed using the NWADMIN Utility (4.x). For example:

NWPA: [V503-A2-D1:0] Compaq SMART-2 Slot 8 Disk 2 NFT

You will use this information later to create a valid partition.

2. Failed hot-plug drives in a ProLiant server or storage system are identifiable by an amber LED on the drive tray. Record the location of the drive bay containing the failed physical drive. This is where the new physical drive must be inserted.
3. Choose one of the following methods:
 - If the failed drive is a hot-plug drive, go directly to step 4.
 - If the failed drive is not a hot-plug drive, schedule storage system down time, take the storage system offline, and power off the unit. Proceed with step 4.
4. Remove the failed drive and insert the replacement physical drive in the same drive bay. The physical drive must be of the same capacity as the failed drive. Be sure that all cable connections are secure. When a hard drive in a ProLiant server or storage system is replaced, the drive LEDs each flash once in an alternating pattern to indicate that the connection was successful. The online LED then illuminates green, indicating that the controller has recognized and successfully initialized the replacement drive. If the online LED does not illuminate after a few minutes, be sure that you added the new drive in the same slot as the failed drive and that the drive capacity is the same as the failed drive.
5. Use the *MONITOR.NLM* **Disk Information** option to select the replaced device. Some versions of NetWare will automatically activate the device when this option is chosen. Other versions of NetWare require manual activation of the device by changing the operating status to Active. If reactivation of the failed logical drive is successful, the driver sends a notification to the console.
6. Use the *INSTALL.NLM* and *NWCONFIG* for NetWare v5 option **Change Hot Fix** (look at the information provided about the mirrored drive, not the failed drive) to determine the number of Hot Fix Redirection blocks set up for this partition.
7. Use the *INSTALL.NLM* and *NWCONFIG* for NetWare v5 to delete and recreate the partition on the repaired logical drive.

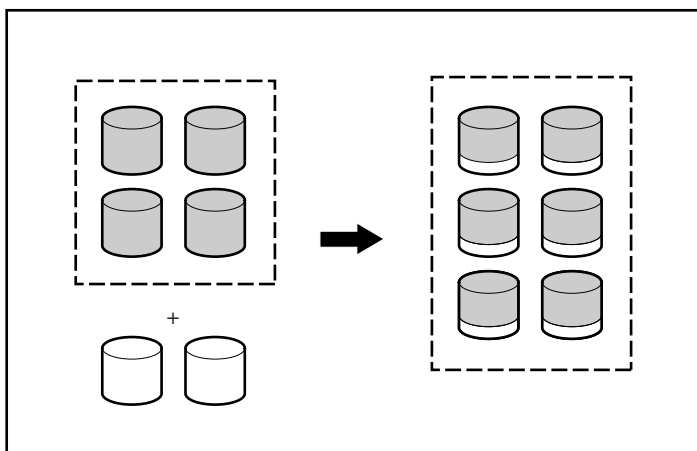
NOTE: Although the logical drive may have a valid partition table, the data on this logical drive is no longer valid. Some data may seem valid because the failed physical drive was only a portion of the arrayed logical drive. However, a hole exists in the logical drive data at this point. Delete any old, invalid data and create a new partition on the logical drive.
8. On the *INSTALL.NLM* **Disk Options** menu, select the **Modify Disk Partitions** and **Hot Fix** option. The driver will send a console alert if reactivation is successful.

9. On the *INSTALL.NLM Available Disk Drives* menu, select the previously failed logical drive, which has now been repaired. The device information was recorded in step 1. For example:

NWPA: [V503-A2-D1:0] Compaq SMART-2 Slot 8 Disk 2 NFT

10. Select the **Delete Partition** menu option. *INSTALL.NLM* may display several error messages. Since you will delete this partition, do not update any **Volume Definition Table** information. Continue until the partition has been deleted.
11. If *INSTALL.NLM* reports that it cannot delete the partition because another process has locked it, load *MONITOR.NLM* and look at the **System Resources** option to determine which NLM has locked the device. It may be *MONITOR.NLM*, so you will need to unload *MONITOR.NLM* and any other NLMs that have the partition locked. After you create the partition and volume information, reload those NLMs.
12. Create the partition on the same logical drive.
13. Create and mount the volume.
14. Locate the recent backup media and restore the data to this server volume.

The expansion process is illustrated in the following figure, where the original array (containing data) is shown with a dashed border, and the newly added drives are shown unshaded (they contain no data). The array controller redistributes the original logical drive over the enlarged array, using the same fault tolerance method. The unused capacity on the new (enlarged) array can then be used to create an additional logical drive, with a different fault tolerance setting if necessary. Alternatively, the extra capacity can be used to increase the size of the original logical drive (capacity extension).



If you are expanding an array that has several logical drives, data is redistributed one logical drive at a time. Newly created logical drives are not available until capacity expansion is complete.

Specifications

Table E-1: MSA500 System Specifications

Specification	Value
Dimensions	
Height	17.5 cm (6.9 in)
Depth	52.1 cm (20.5 in)
Width	48.3 cm (19.0 in)
Weight, no drives installed	22.7 kg (50 lb)
Input power requirements * (US and international)	
Rated input voltage	100 to 240 VAC
Rated input frequency	50 to 60 Hz
Rated input current	7.35 A Max
Input power (max)	641 W *
Power supply specifications	
Rated steady-state power	377 W
Maximum peak power	681 W
Heat dissipation (max) *	2187 Btu/hr *

* Input power and heat dissipation specifications are maximum values and apply to worst-case conditions at a full-rated power supply load. The power/heat dissipation for each installation varies depending on the equipment configuration.

continued

Table E-1: MSA500 System Specifications *continued*

Specification	Value
Acoustic noise (LWAdc bels and LpAm dBA)	
Idle	<6.9 and 53
Fixed disk (random writes)	<7.3 and 54
Temperature range	
Operating	10° to 35° C (50° to 95° F) [derated 1°C per 304.8 m (1.8°F per 1000 ft) of elevation to 3,048 m (10,000 ft)]
Shipping	-30° to 50° C (-22° to 122° F)
Relative humidity (noncondensing)	
Operating	10% to 90%
Nonoperating	up to 95%
Maximum wet bulb temperature	
Long-term storage	29°C (84.2°F)
Short term storage	30°C (86°F)

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